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SOURCES OF ERROR IN COMMON CHEMICAL PROCEDURES*

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Every quantitative determination involves a certain amount of unavoidable error. A desirable method is one in which the errors can be kept at a minimum. In clinical work, where very often the rapidity with which a result can be obtained is of greater importance than extreme accuracy, greater degree of error is allowable. Although any technician who has acquired the necessary manipulative skill will be able to follow directions of a method, her ability to make effective use of the process will be decidedly limited, owing to the fact that unforeseen contingencies for which the carefully worded descriptions of a chemical method did not allow, constantly arise. Often a technician, after faithfully executing the details of a concisely stated description of a chemical procedure as given in some of the textbooks, will end up with a result which is not in accord with the expected values, and she is at a complete loss as to what was the matter, since she could not see where she could have deviated from the procedure. This is often due to the fact that the authors of the method did not elaborate enough on the various steps in the procedure, and that the conditions under which the technician carried out the determination were in some way at variance with the conditions under which the procedure gives good results. In this paper an effort is made to study some of the factors which alter the accuracy of the method. One is not interested in carelessness or sloppiness, which have no place in the clinical chemistry laboratory, but in factors such as timing, temperature, stability, presence of contaminants, and other possible sources

* Third Award Paper, ASMT, 1948.

of error. This study is far from complete, but it is hoped that it may be of some use. Each chemical method is a specific problem in itself, requiring an intensive study of each step in the procedure, and even an exhaustive review of the literature to date could not supply us with all the information possible. Only the chemical determinations in fairly common use are considered.

Blood Sugar

Blood sugar determinations in common usage involve heating the blood filtrate with an alkaline solution containing cupric salt. The cupric ion is reduced and cuprous oxide which is formed is then measured by use of phosphomolybdic acid, arsenotungstic acid, or other color producing agents. The possible sources of error are:

(1) After removal of blood from the body, the glucose undergoes glycolysis. The amount of decrease is reported as follows:

12% first 3 hours.

22% first 6 hours.

32% first 32 hours.

The glycolysis presumably takes place with the aid of an enzyme. It is thought that the presence of red blood cells accelerates the process. Therefore, if a blood filtrate is made which removes both the enzyme and the red blood cells, the sugar content remains constant. The addition of NaF to whole blood greatly retards but does not completely inhibit glycolysis. For complete inhibition of glycolysis a mixture of 1% of sodium fluoride and iodoacetate is recommended.²

(2) Excessive amount of potassium oxalate may cause low results. If more than 30 mgs. per 10 ml. of blood is used, values 4 - 17% too low were observed by the Folin-Wu Method, and 28 - 48% too low by the Myers Benedict Method.³

(3) If chemicals used for the preparation of alkaline copper reagent are not pure, a sediment of cuprous oxide may form after standing. This sediment should be removed by filtration.⁴

(4) Level of fluid should be at the narrow constricted portion of the tube in order to minimize exposure to air and prevent re-oxidation of cuprous oxide by air.⁴

(5) Any undue agitation of the solution containing cuprous oxide will re-oxidize it.

(6) Adequate care should be given to mixing after diluting to 25 ml. mark because the greater part of the blue color is in the bulb of the tube.

(7) Folin and Wu stated that the color comparison can be made at end of 5 minutes to 1 hour.⁴ However, it will be well for the technician to check the color stability of the method she is using by reading the depth of color after varying lengths of time.

Blood Urea Nitrogen

Common methods for blood urea nitrogen involve incubation of blood or blood filtrate with urease. Urea is hydrolyzed and ammonium carbonate is formed. The amount of ammonia formed is measured directly with Nessler's solution, or the ammonia is distilled or aerated off into an acid solution and then titrated or Nesslerized. The possible sources of error are:

(1) Optimum pH for urease activity is 5.0 to 5.5. Below 5.0 there is a sudden fall in activity of the urease.

(2) Excessive amount of tungstic acid in the filtrate inhibits the action of urease.

(3) Presence of traces of heavy metals, such as mercury, will inhibit the action of urease.

(4) Presence of fluoride will inhibit the action of urease.

(5) High urea may inhibit the action of urease. Explanation is given that the compound $\text{NH}_3 \cdot \text{CO} (\text{NH})_2$ is present at higher concentration of urea and acts as an inhibitor.⁵

(6) Principal source of error in direct nesslerization methods is turbidity in the final solution. This turbidity is apparently due to reduction of complex mercuric salt of Nessler's reagent to mercurous compounds. Various protective colloids, such as gum arabic and gum ghatti, have been used to maintain clarity in the final solution, but these substances may markedly affect optical transmission if the colors are read by photoelectric colorimeter. For this reason the stabilizing agents are often eliminated and it will then be necessary to read the color within a few minutes after the color development.

(7) Cloudy solutions after the addition of Nessler's reagent may be due to a variety of causes. Among them are:

(a) Concentration of ammonia is too high.

(b) Nessler's solution is too alkaline.

(c) Nessler's solution is extremely sensitive to acetone. Precipitation of Nessler's can be achieved by blowing acetone fumes over mouth of a tube containing Nessler's solution.

(8) Temperature affects the optical transmission of nesslerized solution. A solution at ice box temperature had approximately twice the optical transmission of a solution at room temperature.⁷ The explanation offered is that Nessler's solution is colloidal in nature and has a higher transmission when cold.

(9) Presence of ammonia in reagents or glassware may cause significant error.

Non-Protein Nitrogen

Principle of non-protein nitrogen methods in common usage depends upon the digestion of blood filtrate with sulfuric acid. The addition of oxidizing agents, such as perchloric acid, hydro-

gen peroxide, etc., helps accelerate the process. The ammonia formed is measured by the addition of Nessler's reagent, directly to the diluted digest. The sources of error are:

(1) Any presence of ammonia in reagents may significantly alter the result.

(2) Cloudiness in final colored solution may be due to

(a) Excessive non-protein nitrogen.

(b) Too weak an acid digestion mixture.

(c) Too great a loss of sulfuric acid during digestion.

(d) Excessively alkaline Nessler's solution.

(3) Bumping during digestion may cause loss. Bumping depends upon the condition of the test tubes. In any test tube the fine pores are filled with air and until air has been driven out by heat, localized formation of steam occurs and keeps boiling smooth and even. After pores have been gradually filled, bumping begins. In case of bumping with repeated use, heat tube to red heat in flame, cool and rinse with alcohol.⁸

(4) Digestion mixture containing sulfuric and phosphoric acid is likely to detach silica from tube, and cloud the solution. Centrifuge a portion. If the sediment is white, readings can be made with the supernatant fluid.

Creatinine

The common creatinine methods involve the measurement of the reddish-orange color when alkaline picrate is added to a blood filtrate containing creatinine. The sources of error include:

(1) Oxalate has a strong bleaching action on the red color, so care must be taken not to add too much.⁹

(2) Standing longer than 10 minutes after the addition of alkaline picrate introduces a large error because the color changes rapidly thereafter.⁹

(3) Impure picric acid develops considerable color with sodium hydroxide alone. To test saturated picric acid for purity: Place 20 cc. of saturated picric acid solution in a small erlenmeyer flask; add 10 cc. of 10% NaOH. Let stand 15 minutes. Compare in a visual colorimeter, using the above solution as the unknown, and saturated picric acid as the standard. The reading of the unknown should not be below 10 if the standard is set at 20.¹⁰

(4) Peters¹¹ found it impossible to duplicate results in summer and winter, and this was attributed to the great variability of the solubility of picric acid with temperature (saturated solution contains 12.2 gms. per liter at 20° C., and 63.3 gms. per liter at 100° C.). Instead of saturated solution, use of one containing 11.75 gms. per liter has been recommended.

Blood Proteins

There are various ways of determining proteins in the blood. The ones in common use are:

- (1) Micro-Kjeldahl method employing direct nesslerization.
- (2) Tyrosine colorimetric method.
- (3) Biuret method.

In all methods the separation of albumin and globulin is usually accomplished by salting out with 22.2% sodium sulfate, or by half saturation with ammonium sulfate at 37° C. The sources of error in the protein determination are largely in the separation of the globulin from the albumin.

(1) The method of half saturation with ammonium sulfate was found to give lower A/G ratio than the sodium sulfate method of Howe.¹²

(2) Variable amounts of albumin are absorbed on the filter paper.^{13,14} Such absorption causes an error in the albumin determination and indirectly an error in the globulin in methods in which it is calculated by subtracting the albumin from the total proteins. The error is even more magnified in the A/G ratio. The amount absorbed was found to be independent of the albumin concentration within rather wide limits, but was found to be dependent on type and quantity of the filter paper. Refiltration of the filtrate through the same paper increased the amount of albumin absorption up to the "saturation" of the paper. Error could be avoided by dividing the serum-sodium sulfate mixture into four portions, each portion being refiltered several times in order to saturate the filter paper. After two such portions have been filtered, the albumin concentration was found to be constant. The filter papers recommended were: Munktell No. 00, Whatman No. 50, and Schleicher and Schull No. 575 (only one filter paper used, 9.0 cm. diam.).¹⁴ Kingsley¹⁵ avoided the use of filtration by adding ether to the serum-sodium sulfate mixture and centrifuging. More recently a method using methanol precipitation has been devised, which gives results which are more in accord with the electrophoretic analysis of the proteins than the sodium sulfate method.¹⁶

(3) Venous stasis tends to increase the protein concentration. Increase of 0.17 gm. per 100 ml. may take place in one minute.

(4) Cooling of extremities may cause increase in protein concentration.

(5) Dry potassium oxalate causes a diffusion of fluid from the corpuscles into the plasma and may lower the concentration of plasma protein.

(6) In the tyrosine colorimetric method, the temperature and the time allowed to elapse between the addition of NaOH and phenol reagent greatly influenced the amount of color developed;¹⁷ the higher the temperature, the greater the amount of color which resulted, and the longer the time allowed for the reaction, the greater the amount of color which developed.

Prothrombin Time

Methods for measuring prothrombin time involve the determination of clotting time when calcium chloride and thromboplastin are added to decalcified plasma. When Quick's prothrombin test was first used, the only information necessary was whether the prothrombin time was normal or prolonged. With the introduction of dicumarol therapy, it is now necessary to know the exact degree of prolongation and the exact amount of prothrombin deficiency. Quick maintained that with the addition of a fixed quantity of calcium chloride and an excess of thromboplastin, prothrombin is the only variable, and the clotting time can be considered as a direct measure of the prothrombin concentration of the blood. There are a number of factors influencing the prothrombin time:

(1) Factor having the greatest influence is the activity of the thromboplastin.

(a) Activity of the thromboplastin depended largely on whether the brain was extracted with acetone or not. Thromboplastin was more active when extracted with acetone; however, the activity varied more from one batch to the other.¹⁸

(b) Saline thromboplastin extracts prepared according to the same general methods do not always possess the same activity. The activity depended on:

Fineness of the powdered brain.

Length of time of incubation.

Amount of mixing prior to, during, and after incubation.

Period of centrifuging.

It is important to check the thromboplastin against a normal and a 20% dilution of normal plasma, and it is advisable to discard it if the activity varies too much.

(c) If stored at 5° C., both the dried rabbit brain and suspension of rabbit brain powder is stable for some time (six months).¹⁹

(2) Prothrombin may deteriorate markedly within 24 hours.

(3) Concentration of calcium chloride is extremely important. Increasing the concentration of calcium prolongs the prothrombin time.²⁰ Reducing the strength of calcium chloride shortened the prothrombin time.¹⁸

(4) Convertibility of prothrombin to thrombin is influenced by pH, temperature, and electrolyte concentration.¹⁸

(5) Gross lipemia shortens the prothrombin time.²¹

(6) Slight hemolysis does not alter the prothrombin time appreciably, but gross hemolysis will shorten it sufficiently to invalidate the result.²²

(7) Increasing the ratio of blood to oxalate increases the prothrombin time.

(8) Time of incubation of the plasma-thromboplastin mixture may influence prothrombin time.²²

(9) Violent agitation of the tube while watching for clot formation will break the fibrin mesh and more time will be required for further formation of fibrin and lengthen the prothrombin time.²³

(10) As little as 0.1 mg. per cent of heparin in the blood will have a detectable influence on prothrombin time.²³ Prothrombin time should not be done until about four hours after the heparin has been given.

Sulfonamides

Sulfonamide determinations depend on the measurement of diazotizable primary amines and coupling in an acid solution with N— (1-naphthyl) ethylene diamine dihydrochloride. Possible sources of error in this method are:

(1) Brownish color in the final solution is due to failure of destroying all the excess nitrate. The purpose of adding ammonium sulfamate is to decompose the nitrite. Failure of destruction of the nitrite may be due to:

(a) Excess sodium nitrite.

(b) Too weak an ammonium sulfamate solution.

(c) Inadequate mixing after the addition of ammonium sulfamate or insufficient length of time allowed for the reaction.

(2) Ascorbic acid interferes with the determination of sulfanilimide when the ratio of ascorbic acid to sulfanilimide is 1:2 or greater.²⁴

(3) Para-amino benzoic acid and novocaine give identical color reactions as the sulfonamides.

Cholesterol

Methods usually involve the extraction of blood with alcohol-ether mixture. The alcohol-ether extract is evaporated to dryness, the residue extracted with chloroform, and the cholesterol is colorimetrically determined by Liebermann-Burchard's reaction with the use of acetic anhydride and concentrated sulfuric acid. Probable sources of error are:

(1) Total cholesterol content of serum does not change significantly on standing, but cholesterol esters show variable changes, probably due to esterase activity in the blood.²⁵

(2) Chloroform used in the determination should be of high grade and free from water. Presence of moisture will produce off shade color, or will prevent color development.

(3) Any heating after drying may produce a brown color

which passes into chloroform and renders subsequent determination difficult.²⁶

(4) Color development at 5° C. will prevent brown color, which may result after addition of acetic anhydride-sulfuric acid mixture.²⁷

The determination of ascorbic acid usually depends upon the reducing action of ascorbic acid on a dye such as 2-6-dichloroindophenol. The amount of ascorbic acid is related to the amount of dye reduced. The latter is measured colorimetrically by the amount of dye decolorized, or it is titrated. The important factor in the ascorbic acid determination is its stability in the blood.

(1) There appears to be some disagreement on the question of stability of ascorbic acid in the blood. To prevent loss, use of KCN (1-2 mg. per c.c.) has been suggested.²⁸ It has since been shown that KCN does not exert any uniform protective action.^{29,30} Certain lots of KCN act on 2-6-dichloroindophenol and decolorize it. This reduction action of KCN was traced to contamination of the reagent with ferrocyanide.³¹ Vitamin C is more rapidly oxidized in plasma than whole blood. If plasma is kept in contact with red cells, vitamin C is reported to remain stable for as long as 24 hours at refrigerator temperature.^{30,31,32,33} After separation of plasma, it can be kept only 3 to 4 hours at refrigerator temperature, while there is a rapid loss at room temperature. The stabilizing effect of red blood cells is thought to be due to the presence of glutathione, which acts as an anti-oxidant. When blood is hemolyzed, the presence of oxyhemoglobin will cause diminution of ascorbic acid. About 35% may be lost in one-half hour.³¹

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**"AN EXPLANATION OF THE TERMINOLOGY AND
DEFINITIONS RECOMMENDED BY THE COMMITTEE
FOR CLARIFICATION OF THE NOMENCLATURE OF
CELLS AND DISEASES OF THE BLOOD AND
BLOOD-FORMING ORGANS"***

MARGRET E. HUGHES**

INTRODUCTION

The first report¹ of a committee for clarification of the nomenclature of cells and diseases of the blood and blood-forming organs was published in the May issue of the *American Journal of Clinical Pathology*, in the section devoted to "News and Notices," and also in the *Technical Bulletin* of that journal, which is sent to all registered medical technologists. This committee is sponsored by the American Society of Clinical Pathologists and the American Medical Association. The published report of the committee's recommendations for preferred nomenclature in hematology is of necessity brief and concise and, except for a general statement regarding policy, guiding principles and scope of the committee's functions, the reasons which resulted in making specific recommendations are in many instances not given in the report and may not be apparent to all readers. Everyone will have an opportunity to read the report and is encouraged by the committee to express his or her approval or disapproval of the recommended nomenclature and to make any suggestions for additions to or modifications of the terminology.

For the time being these recommendations are to be considered tentative until they have been widely read and studied and an analysis has been made of the consensus of opinion regarding them from those persons in medicine and related fields who use hematology nomenclature. It should be noted that these recommendations represent the opinion of the majority of the committee members, who were representative of all points-of-view in hematology and also of various geographic regions. A complete report of the detailed discussions and reasoning which took place at committee meetings or which were expressed by the individual committee members in correspondence back and forth with the committee chairman is not contemplated at this time. For this reason the published report should be read as carefully and as objectively as possible, realizing at all times that thoroughly competent and leading hematologists, pathologists, laboratory directors, anatomists and medical editors have discussed the subject of hematology nomenclature in formal and

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** From the Division of Experimental Medicine, Medical Research Foundation, University of Oregon Medical School, Portland 1, Oregon.

informal conferences, have impartially and inclusively evaluated all currently used terms, and even some obsolete ones, and from this have discussed and debated the points for and against each term, for the purpose of determining by mutual agreement which one term can be applied to a given cell or disease and be the most descriptive, accurate and easily and generally understood name, eliminating all others which have been used for the given cell or disease or for one closely related to it. Each term is accompanied by an unequivocal definition of the differential criteria for identification, as well as a statement giving the sharply delineated boundaries for each cell type.

The primary function of the committee was to determine those areas in nomenclature where mutual agreement already existed among the different schools of hematology, and also those areas where agreement could be reached by redefining a term to make it broader or more restricted and thus unequivocal. The main attempt was to determine where the same term had been used with only different degrees of meaning, where the same cell or disease had been identified by different names and where one particular term had been given many of several different meanings.

Purposes and Principles of the Committee for Nomenclature

The purpose of this paper is to present to medical technologists some of the background of the committee so that they will have a greater understanding of the recommended terminology and thus be able to use it intelligently and accurately, so that the confusion, duplications, misunderstandings and inaccuracies that have existed in hematologic literature and reports need not be continued, and so that everyone, no matter from what school of hematology or from what laboratory, will be speaking essentially the same language. Nothing that is given in this paper is original with the writer, who is acting only in the capacity of a reporter who has had the opportunity to know in detail the work which was undertaken by the committee.

The primary goal, motivating the formation of this committee, was to facilitate the teaching of medical students and student laboratory technicians, and to simplify and correlate somewhat the work of the hematology technician and that of the practicing physician. Few of these individuals have the time or sufficient opportunity to know thoroughly each system of nomenclature and standards of criteria used by the several different schools of hematology and the many clinical and research laboratories in this and other countries. Hematologists and others who have sufficient time for extensive specialized study probably are not confused by the lack of clarity in nomenclature and can readily

translate from one system to another so long as they can identify a given term with a given system and know the criteria of that system. The average busy physician and technician seldom has this familiarity with the entire field. The work of each could be more positive with fewer misunderstandings if in all laboratories physician and technician use the same set of terms for the cells and diseases of the blood and blood-forming organs and at all times each has the assurance that the other knows thoroughly and exactly what is meant and what limitations are implied in the name or qualifying description of a blood cell or condition.

There is a potential benefit that may be facilitated through the medium of a standardized system of nomenclature in hematology which should be pointed out to medical technologists. Frequently many of us find ourselves taking the passive attitude that there is little which we as technicians can add to the sum and substance of present-day knowledge in one or another field of endeavor. The direct cause for the development of such an attitude may be an individual matter, but the concept must be recognized and evaluated that such an attitude frequently may be aggravated by a prevailing state of confusion, by a babel of tongues, preventing many from rising above the haze to become proficient with the means and media through which theory may become evidence and knowledge may more nearly approximate truth. If a single mode of expressing an idea or describing a phenomenon is not available to all working in a given field, the significance and application of a casual or random observation made, for example, by a medical technologist in the course of her routine work may be greatly delayed in coming to the attention of some other worker who has made a related observation and which if fitted in with the first one may form a positive piece of evidence. Although it is speculation, it seems important to emphasize this aspect in order that the objectives of the program to clarify nomenclature in hematology be fully understood.

One criticism which could justifiably be made of such a project to standardize and simplify is that this sometimes tends to hinder progress, for it is frequently assumed that once something has been standardized it is a finished project. However, by stating its purposes and limitations clearly and objectively, the nomenclature committee has been able to minimize the possibility of seeming to encourage only standardization.

In general the recommendations of the committee are based on the following principles:

1. To define those terms in hematology relating to the cells and diseases of the blood and blood-forming organs where, so far as present-day knowledge goes, there are no major, honest

differences of opinion as to site of origin, mode of differentiation or development, and criteria for identification.

2. Questions of fact where differences of opinion do exist are to be noted in the committee's reports with a statement to the effect that it is agreed to disagree until further experimental evidence has been produced.

2. It is more important to recommend *a* name, one name only, than to give the *right* name, especially since present-day knowledge is far from complete. Broad, general, sharply defined terms, maintaining comparable terms as far as possible among the different cell series, and recommending that all terms be periodically reviewed and revised will in no way commit anyone using the recommended nomenclature to any arbitrarily decided fact, where differences still exist.

4. The simplest, most descriptive and most generally applicable term should be chosen wherever possible. Historical priority, eponyms and common usage, especially where the latter has deteriorated into medical jargon, should not be given preference, if a more descriptive term is available.

5. By recommending the use of clearly defined qualifying adjectives when describing a particular cell at one stage of its development, followed by the term recommended to designate the broad group into which it falls, an expansion of the recommended nomenclature can develop automatically along prescribed, systematical lines.

Examples of how these principles were applied in specific instances will be given later.

Organization of the Committee for Nomenclature

In the summer of 1947 the president of the American Society of Clinical Pathologists appointed Edwin E. Osgood, M. D., Professor of Medicine, University of Oregon Medical School, to be the chairman of a committee to clarify the nomenclature of cells and diseases of the blood and blood-forming organs, and asked that he choose a representative group to undertake this project and make periodic reports of recommended terminology to the Society. About 40 persons, representative of this country as well as of Canada and Great Britain, were asked to serve on the committee. Suggestions for persons to be included came from a number of different sources and all who were asked to serve had the approval of the officers of the American Society of Clinical Pathologists. Each was asked to make a list of the terms currently used in his laboratory, his teaching or his writing, and to indicate what terms he preferred to use if mutual agreement were achieved. After a preliminary survey by correspondence, a meeting of the committee was held in Chicago,

October 25-26, 1947, to discuss terminology and to make recommendations for preferred terms. The list of committee members who have approved the first report is given in Table 1. It includes not only those who were able to attend the Chicago meeting but also those who endorsed the recommendations after having read a preliminary summary report of the proceedings. To those who are familiar with the names of men active and prominent in hematology and related fields the list is probably impressive and highly representative. To some the names of a few prominent men may be conspicuous by their absence. The reasons for this can be listed as follows:

a. Although the first aim was to make the committee completely representative of all geographic regions, points-of-view and all related fields, there was a limit to the number who could actively take part without having the committee become unwieldy. The members are merely representative and no relative standing is implied.

b. Some men who were asked to serve had to decline because of previous professional or personal commitments. Nearly all of these expressed complete sympathy with the program.

c. Although about 40 persons were asked to serve on the committee and have received all of the preliminary plans and programs and subsequently all the reports of activities and recommendations, only two of these stated they did not wish to be identified as endorsing the recommendations made so far.

Table 1. List of Committee Members Who Have Approved the First Report for Publication

Howard L. Alt	S. E. Gould
Lawrence Berman	Russell L. Haden
Frank Bethell	Byron E. Hall
O. A. Brines	George Halperin
C. G. Culbertson	F. J. Heck
T. J. Curphey	J. M. Hill
William Dameshek	Roy R. Kracke
Charles A. Doan	L. R. Limarzi
Hal Downey	Stacy R. Mettier
Ernest H. Falconer	J. J. Moore
R. F. Farquharson	Edwin E. Osgood
Morris Fishbein	Isabella H. Perry
Alvin G. Foord	Stanley P. Reimann
Claude E. Forkner	Nathan Rosenthal
Willis M. Fowler	S. O. Schwartz
A. S. Giordano	L. J. Witts

Summary of Recommendations

At the first meeting of the nomenclature committee all discussions and procedures were informal, and a stenographic

record of all remarks was maintained. Atlases of hematology, stained blood and marrow smears and microscopes were available to the members for reference and illustrative purposes. A systematic approach to the problem was outlined by the chairman and from this every committee member presented on each point his preference as to individual past usage, his critical concept of each term brought up for consideration and finally which term he felt best suited the individual series of cells and each cell in all instances.

Table 2 gives a summary of the descriptive terms recommended and also those to be avoided when referring to cells of a particular series or to a disease affecting any cell of that series. In all instances the suffix *cytic* is to be used, for it means by derivation "of or pertaining to the cells of" a specific series. The endings *ogenous* or *oid* could not be recommended by the committee as the suffix to be used for all series, since the former designates the site of origin or the mother tissue, and the latter means "like, or of the shape of." To use the suffix *ogenous* would infer that the site of origin of all cells had been established by either fact or arbitration, neither of which is the case; indeed, there are several opinions regarding origin of some of the cell series and each proponent can present substantial evidence, none

Table 2. Recommended Terms and Terms to Be Avoided When Referring to Cells of a Particular Series or to a Disease Affecting Any Cell of the Series

Term to be Used	Terms to be Avoided
Lymphocytic	Lymphoid, lymphatic, lymphogenous, lymphocyte, mononuclear
Granulocytic	Myeloid, myelogenous, myelocyte, myelocytic, granulocyte, leukocyte, leukocytic, leucocyte, leucocytic
Monocytic	Monocytoid, monocytogenous, mononuclear, monocyte
Plasmacytic	Plasma cellular, plasmacytogenous, myeloma cell, plasmacyte
Erythrocytic	Erythroid, erythrocytoid, erythron, erythrocytogenous, erythrocyte
Thrombocytic	Megakaryocytic, platelet, thrombocyte

of which has been disproved. Examples of how the suffix *ogenous* could not be used would be "monocytogenous" and "plasmacytogenous" or "myelogenous" in the sense of indicating only one cell series.

In a similar manner the suffix *oid* was defined, discussed and

eliminated. In using the word, for example, "lymphocytoid" one would be describing all basophilic cells with a round nucleus, for there are several cell-stages in other series which are "like, or of the shape of" a lymphocyte, although each has a specific differential point. "Lymphoid" means like or of the nature of lymph and hence is misused when applied to a cell series.

In deciding on the best descriptive term for each cell series it was the feeling of the committee that the cell series as a whole was of primary importance to the purposes of this committee's recommendations and that the name chosen should not in any way indicate a particular stage of development. For the sake of convenience it was arbitrarily decided to use the prefix derived from the name of the most mature stage in each series, with one exception, and by definition to make this term inclusive of all the precursors of that mature form, whether normal or pathological. Whenever it is found necessary to indicate only one stage of a cell series, when referring to the series in general, this should be done by means of a qualifying adjective; for example, instead of describing the disease as "acute lymphoblastic leukemia," it is recommended by the committee that the same pattern be followed in all disease designations which is exemplified by the names "acute lymphocytic leukemia, lymphoblastic type" or "acute lymphocytic leukemia, microlymphocytic type."

An important question of fact was discussed by the committee in the process of giving a preferred name to each of the cell series and the exact position and attitude of the committee should be made indisputably clear, so that future research and the acquisition of more exact knowledge will in no way be hindered. By designating six distinct cell series, mature forms of each being readily distinguishable in normal, adult blood, the committee does not mean to imply that it accepts or rejects either in part or whole the belief that the precursors of these six types are distinct cells all the way back to the most undifferentiated forms. It admits that present knowledge is inadequate to establish or disprove this with certainty.

In choosing the name "granulocytic" for the cell series which is represented in normal blood and marrow by those cells containing specific granulation, as demonstrated in any of the Romanowsky stains, the committee considered a vast number of currently used terms, but felt that "granulocytic" was the most descriptive and unequivocal, when defined to pertain only to cells and their recognizable precursors with specific granules; i.e., neutrophilic, eosinophilic and basophilic. The term "myelocytic" was not recommended on the basis that by actual meaning it would have to include all cells coming from the marrow, and

this would make it too inclusive a term which could not be justified even by specifically redefining it.

After mutual agreement was reached on the number of cell series to designate and the names for each, the committee devoted itself to a consideration of the individual stages in each cell series, deciding first how many stages of differentiation were of clinical significance for diagnostic and prognostic purposes, defining exact boundaries for these stages and finally deciding on the best name for each. In research more subdivisions may be needed than are at present provided by these recommendations, but these can be obtained by the use of exactly defined qualifying adjectives.

In Table 3 are listed the terms in each cell series which are recommended, and also the terms to be avoided, when referring to specific cells of the blood and blood-forming organs. Many of these need no further explanation, especially if one refers to the first report of the committee which gives the exact definition for each recommended term. However, a few terms which are admittedly the result of compromise need some words of explanation.

The definitions to be attached to the suffix *blast* and the prefix *pro* must be unequivocally defined. It is admitted that the most undifferentiated cell of each series—the *blast* cell—is difficult to identify with certainty as belonging to a specific series, for all are morphologically similar. Therefore, a very broad definition must be given for this cell type. Any cell seen in a pathological blood smear, a bone-marrow preparation or a tissue imprint with fine chromatin structure, usually demonstrable nucleoli and basophilic cytoplasm, with or without azurophilic granules, is to be classified as a blast cell, to be specifically identified later, depending on the recognizable type-cell which accompanies it. In defining a *blast* cell the committee does not mean to imply that unanimity has been reached regarding the specificity and individuality of these immature, undifferentiated forms. It merely recommends that for the time being the most undifferentiated cell seen be specifically identified as a blast cell of the specific series which is recognizable by the preponderance of more mature forms of that series.

From the medical technologist's point-of-view perhaps one of the most important recommendations resulting from the committee's deliberations can be summed up as follows: any recommended term should be broad and inclusive with fairly exact boundaries which are well known. Whenever a cell is placed in an undifferentiated category by a technologist, this should be a clue to the physician that a more authoritative source of information is needed in order to determine the exact status of

Table 3. Recommended Terms and Terms to Be Avoided When Referring to Specific Cells of the Blood and Blood-Forming Organs

Name of Series	Term to be Used	Terms to be Avoided
Lymphocytic	Lymphoblast	Myeloblast, hemocytoblast, lymphoidocyte, stem cell, lymphocyte
	Prolymphocyte	Large lymphocyte, pathologic large lymphocyte, atypical leukocytoid lymphocyte, monocyte, immature lymphocyte
	Lymphocyte	Small, medium or large lymphocyte, normal lymphocyte, small, medium or large mononuclear
Monocytic	Monoblast	Myeloblast, hemocytoblast, lymphoidocyte, lymphocyte, stem cell, immature monocyte
	Promonocyte	Premonocyte, hemohistioblast, immature monocyte, Ferrata cell
	Monocyte	Large mononuclear, transitional, Plasmacyte, endothelial leukocyte, histiocyte, resting wandering cell
Granulocytic	Myeloblast	Granuloblast, hemocytoblast, lymphoidocyte, lymphocyte, stem cell
	Progranulocyte	Promyelocyte II, leukoblast, myeloblast, promyelocyte, promyelocyte, progranulocyte A
	Myelocyte	Granulocyte, myelocyte B, non-filament, class I
	Metamyelocyte	Metagranulocyte, juvenile, myelocyte C, non-filament, class I
	Band cell	Staff cell, stab cell, non-filament, class I, rod nuclear, polymorphonuclear, stabkernige, rhabdocyte, non-segmented
	Segmented cell	Polymorphonuclear, filamented, class II, III, IV or V, lobocyte
Plasmacytic	Plasmablast	Myeloblast, hemocytoblast, lymphoidocyte, lymphocyte, stem cell, lymphoblastic plasma cell, myeloma cell

Name of Series	Term to be Used	Terms to be Avoided
Plasmacytic	Proplasmacyte	Turk cell, Turk irritation form, lymphoblastic or myeloblastic plasma cell, myeloma cell
	Plasmacyte	Plasma cell, Unna's plasma cell, Marschalko plasma cell, plasmacytoid lymphocyte, myeloma cell
Thrombocytic	Megakaryoblast	Megalokaryoblast
	Promegakaryocyte	Premegalokaryocyte
	Megakaryocyte	Megalokaryocyte
	Thrombocyte	Platelet, thromboplastid
	Disintegrated cell	Senile cell, smudge, basket cell, smear cell, degenerated cell

that cell. This recommendation is not meant to result in a "stock pile" of undifferentiated cells, but rather is meant to encourage the reporting of any and all unusual cells seen and to discourage any possible tendency to ignore them rather than admit one cannot identify them. It then rests with the hematologist to determine with the best of his knowledge whether or not an unusual or unidentified cell is pathological. If hematology technologists acquire as much knowledge as possible regarding the normal morphological range of cells and the variations which occur according to environment or source and disease process, they should be able to recognize with assurance the unusual cells, whose identification may result in more exact knowledge regarding the relationships and potentialities of the various cell series.

In general the *pro* cell is defined as a cell intermediate in morphological differentiation between that which is recognized as a *blast* and the mature, completely differentiated form. Here again it is essential for the medical technologist to exercise judgment and integrity, realizing that the final responsibility for identification rests more with the expert hematologist and pathologist. Her province primarily is to report the occurrence of immature cells and to identify them more specifically as her knowledge and experience under authoritative guidance expand.

Regarding the general and relative distinctions which have been recommended in describing chromatin structure, it is recognized that there is a continuous rate of structural differentiation, but for diagnostic and prognostic purposes only three or four

patterns need to be distinguished. The most undifferentiated nucleus is described as having fine chromatin structure which is defined as having the appearance of a background of homogeneous lighter-staining parachromatin, overlaid by a darker-staining lace-net meshwork or finely stippled pattern of basichromatin, with no aggregation of basichromatin into even a single clump of appreciable size staining darker than any other areas in the nucleus. The chromatin material of mature cells is markedly clumped, and the intermediate stage between these two extremes has been designated arbitrarily as the *pro* stage for the cell type, to be identified more specifically, if the occasion demands, by the hematologist through the use of qualifying adjectives.

The recommended terminology for the granulocytic series should be described, for in it occurs the one exception to the general pattern of nomenclature outlined by the committee. This series does not take its name from the most mature form as is done in the other series. Many of the recommended terms are the result of compromise, based on the admitted fact that terminology in this series has been most confusing. Each school of hematology has used a given set of terms, some of which duplicate the terms of other schools, but which are applied to different stages by each. It has been continuously necessary to translate from one system to another in teaching students or interpreting hematology reports.

Myeloblast was chosen as the recommended term for the most undifferentiated cell, because it occurs normally in the marrow, which is all that that name implies. It may, according to some schools of thought, be the precursor of one or more separate cell series; it may or may not differentiate along granulocytic, monocytic, erythrocytic or megakaryocytic lines. By using this name for the cell no one is committed to any one theory regarding its potentialities.

The next stage to be differentiated as clinically significant has been termed the *progranulocyte* and is defined as the cell which will give rise only to cells having *specific granulation*, although at this stage no specific granulation can be demonstrated. *Promyelocyte*, as the name for this stage was considered by the committee, but mutual agreement could not be attained so it was discarded. Although its use is consistent with the general pattern recommended for the other stages in this series, it has been used in the past with too many different meanings. Another objection to its use is that by derivation the word *promyelocyte* could be defined as the precursor cell of all marrow cells and such a scope is not intended. The term *leukoblast* for this stage was also discussed and discarded, since it was generally agreed that by exact

definition it should be applied only to the mother cell of all leukocytes, and such a cell has not yet been differentiated with certainty.

The term *granulocyte* is defined as an inclusive term to apply to any cell containing specific granules. The plural form *granulocytes* would therefore include all myelocytes, metamyelocytes, band cells and segmented cells, whether neutrophilic, eosinophilic or basophilic.

The terms *myelocyte* and *metamyelocyte* are recommended to designate the next two stages in this series. These two terms have been extensively used in the past in several systems of nomenclature and there has been quite general agreement concerning their applications. They are normal marrow cells and that is all these terms imply. All cells of this series more mature than the progranulocyte show specific granulation and it is suggested that the type of granulation be indicated. Qualifying adjectives are recommended to point out observed irregularities in the course of maturation of this cell series. It is recognized that normally cytoplasm and nucleus differentiate in a synchronized way, but in some processes one or the other may develop faster or lag markedly behind. To illustrate, in leukemias and other diseases it is frequently observed that a cell of the granulocytic series may maintain its nucleolus and relatively fine chromatin structure after it has developed specific granulation; or another cell may have an indented, relatively coarse nucleus with a marked amount of immature basophilia and sparse specific granulation in the cytoplasm. These deviations from normal should be noted and this can be done by the use of well-defined, qualifying adjectives, at the same time placing the cell in the category where it best fits. For example, the first abnormal cell described might be classified as an *early* neutrophilic myelocyte, if *early* is defined as a cell with specific granulation but still containing the immature nucleus of the pro-stage. The second abnormal cell described might be defined as a *toxic* neutrophilic metamyelocyte, when *toxic* is defined to include basophilia of the cytoplasm and sparsity of specific granulation.

The two forms of this series occurring normally in the blood have the recommended names of *band cell* and *segmented cell*. It was felt that these terms have been least misused and are perfectly clear and unequivocal, whereas previous names for the stages have been given too many different meanings. Some of these are deeply entrenched in the literature and in common usage but it was the belief of the committee that that was not reason enough to retain them. Polymorphonuclear is difficult to say and has had too many different applications attached to it. In addition it frequently deteriorates into medical slang.

Exact definitions for sharp lines of demarcation between the cells of the granulocytic series and the criteria for identification of all leukocytes are given in the committee's first report and will not be repeated here. The cells of the erythrocytic series have not been completely discussed by the committee, but will be its main undertaking at the next meeting to be held in Chicago June 18-20, 1948. Other projects yet to receive the consideration of this committee are the diseases of the blood and blood-forming organs, the cells of the reticulo-endothelial system and such other cells as are occasionally encountered in blood and marrow smears and various tissue imprints and sections. Subsequent recommendations for terminology by this committee will be published in a manner similar to that which was done for the terminology recommended for the leukocytes of the blood and blood-forming organs.

Summary: A brief description has been presented giving some of the reasons for the recommendations as to preferred hematologic terminology made by a committee for clarification of the nomenclature of cells and diseases of the blood and blood-forming organs. The committee is sponsored by the American Society of Clinical Pathologists, and its first report¹ has been published. The information contained in the present paper was obtained from the transcribed report of the proceedings of the first committee meeting, which has not been published.

REFERENCE

1. "First Report of the Committee for Clarification of the Nomenclature of Cells and Diseases of the Blood and Blood-Forming Organs," (In "News and Notices") *Am. J. Clin. Path.*: **18** May, 1948.

METHODS OF WASHING GLASSWARE*

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The purpose of this paper is to provide a summary of methods in common use for the cleaning of laboratory glassware. While general methods may be more or less universal, there are special technics and tricks which help with special problems. Perhaps this information will serve best as a reference guide to washers of laboratory glassware, and to teachers and supervisors of these processes.

Shall we first review general methods? There are several formulas for preparing the commonly used sulfuric acid-bichromate cleaning solution. Most of these result in a dilute acid solution. Add the acid slowly to the water or dilute bichromate solution. We use a simple mixture of concentrated commercial grade sulfuric acid, and enough technical grade potassium bichromate to produce a dark brown color after a few minutes shaking. This solution cleans instantly, and soaking periods are unnecessary. Sodium dichromate or chromium trioxide may be used instead of potassium bichromate.

The cleaning solution may be used warm or hot for greater efficiency. These solutions oxidize organic matter, and may turn green and deteriorate rapidly. Thorough rinsing of glassware, so that no dirt is visible, before immersing in the cleaning solution, will help to preserve the fluid. An orange precipitate may form as the solution becomes used. Adding more acid will preserve the cleaning properties for a limited length of time.

Rinsing well with tap water, and with several changes of distilled water after the use of acid cleaning solution, is imperative. Traces of chromium, if left on glassware, may prove toxic to micro-organisms. If water collects in drops or patches, the glass is not clean. Water should completely wet all of the interior surface, and run off leaving a thin film. Glassware may be allowed to drain dry. Heating in an oven at 160° C. for one hour will dry and sterilize glassware.

Tobie¹ suggests soaking glassware in a cold mixture of 10% nitric acid in sulfuric acid, to remove traces of grease. This same mixture used moderately hot, will oxidize large amounts of organic material. As necessary, more nitric acid may be added slowly to the cooled solution. This mixture should be used under a hood. It should last several months. He also states that chlorates and perchlorates in sulfuric acid cleaning baths are ex-

* Read before ASMT Convention, June, 1948.

tremely dangerous, and that sodium or potassium nitrates have no advantage over nitric acid. In fact, his belief is that any solid salt makes a bath viscid and shortens its useful life. Hot nitric acid alone is also very effective in oxidizing organic matter. Use under a hood! A 2% solution of HCl is recommended for removing free alkali for new glassware.

There are many relatively new detergents sold commercially to be used for washing laboratory glassware. These are good for removing old sediments and chemical deposits. Some are neutral in reaction, while others contain mild alkaline material, as carbonates, silicates, and phosphates. Too strong an alkali would tend to etch soft glass.

Trisodium phosphate, an ingredient in many cleaning preparations, may be used in a 1% or stronger solution. It is especially good for removing greasy films. A mixture of 60 grams trisodium phosphate, and 30 grams sodium oleate, in 50 c.c. water is good. A hot or cold mixture of 120 grams NaOH in 120 c.c. water, diluted to a liter with 95% alcohol, is recommended for tarry and greasy residues. Sodium hexaphosphate and sodium metaphosphate may also be used. Many workers use mild soap flakes and powders.

To determine if the final rinse water is distilled, add a few drops of silver nitrate. A cloud indicates the presence of chlorides and probably other salts.

Good brushes facilitate the mechanical part of the cleaning processes. Brushes with nylon bristles resist chemical attack much better than those with ordinary bristles. Allow brushes to dry between usings.

Abrasives should not be used on glassware, as they eventually spoil the surface by clouding with minute scratches.

A commercially available washing machine has revolving discs arranged to support adjustable trays and beakers, which carry the glassware into the washing solution, and out again to drain. Ordinary salt deposits, blood clots, rings and wax pencil marks are removed. Hot and cold water rinses are used. Steam is turned on if the glassware is to be sterilized. Adjustable screens hold larger items. A special washing powder, sodium metaphosphate, acts as a water normalizer.

Most references urge the boiling of new glassware in washing soda. Continue the cleaning processes employed for used glassware.

There are several special methods for cleaning test tubes. Davidsohn and Yagle² have described a clamp which will hold a wire net at the top of a test tube rack. This arrangement keeps the test tubes in the rack while it is immersed into various

cleaning and rinsing solutions. Test tube edges are not chipped with the use of this apparatus.

Morton² has described a covered wire basket specially designed for cleaning short test tubes. The basket is four inches deep. Gunderson and Anderson⁴ use a stainless steel wire cloth to make baskets to hold test tubes. The baskets are lowered into the cleaning and rinsing agents, making these processes much easier and quicker. The baskets can be used for approximately 4,000 hours. They claim this method results in uniform and complete cleansing, rinsing, and drying of each tube, a saving in the cost and time required for cleaning operations, and a reduction in the breakage of tubes to negligible quantities. It also reduces to a minimum the danger of acid burns to the individual cleaning the tubes, and the cleaning solution lasts much longer. Specially designed brushes attached to a power washer, for the purpose of brushing waste material from test tubes, has been described by Morton.⁵

Glass beakers, packed with test tubes, may be filled with or immersed in cleaning and rinsing solutions. We have used this method to eliminate the time-consuming element of washing tubes individually.

Brushes with tapered ends are good for cleaning centrifuge tubes. Another brush has bristles in the center, allowing the brush to be drawn back and forth in narrow tubing.

Nessler's solution, adhering to the test tube from a previous test, will interfere with the action of urease used in testing for urea nitrogen. For the incubation, use test tubes that have never contained Nessler's solution, or wash tubes with nitric acid and rinse well before use.

Use a few drops of 10% ferric chloride for cleaning urine test tubes used with Benedict's solution.⁶ The final solution of the Folin-Wu blood sugar may be saved and also used for cleaning these test tubes.⁷

Several authorities recommend the use of aqua regia for cleaning tubes to be used for colloidal gold tests, while others use the sulfuric acid-bichromate solution. Remember, in this test, that one dirty tube could spoil the delicate reaction in all of the tubes.

Special procedures are necessary to clean tubes contaminated with bacteriological cultures. They may be placed in 2 to 5% cresol, or a weak lysol solution, for 24 hours. Non-spore-bearing bacteria are killed almost instantly by a boiling temperature, but spores resist destruction for many hours at 100° C. Remember that the boiling point is lower at mountainous elevations. Steam is extremely efficient when penetration is necessary. Contaminated tubes may be autoclaved and emptied while still

warm. If tubes have paraffined stoppers, boil in 5% soap solution after autoclaving. Continue washing as for other glassware.

Loeffler tubes may be autoclaved after being filled with a mixture of 1% trypsin and 0.7% solution of normal NaOH.⁸

Tubes for use in serological tests must receive special attention. Use of the sulfuric acid-bichromate cleaning solution seems almost universal for cleaning serological glassware. Authorities advocate sterilization for 30 minutes at 160° C. in a hot air oven.

Jones and Reid⁹ have described a suction arrangement which will clean and rinse several slender tubes, as those used for the Wintrobe sedimentation rate, simultaneously. We have used a dropping pipette with a long thin capillary end, fastened to the rubber of the siphon from a distilled water bottle, to clean these tubes. The capillary is inserted in the end of the tube, and water from the distilled water bottle completes all rinsing processes speedily.

Shall we next consider methods for cleaning flasks and bottles? Mechanical cleaning is facilitated by the use of brushes. Flexible curved handles help when used for large narrow-mouthed bottles. A swivel joint permits the brush to conform to various shapes of glassware. One brush has four rows of tufts and a double tuft at the end which will reach into corners of jars.

Pickett and Garrett¹⁰ have adapted a Freedman bottle washer, which may be purchased in a hardware or beverage supply store, into a washer suitable for washing laboratory bottles. The instrument is attached to an ordinary water faucet, and a rubber-coated pressure bar, upon which the bottle is placed, facilitates the cleaning process and helps to eliminate breakage.

Volumetric glassware having traces of oil or grease on the surface of the glass may have drops of solutions clinging to the walls, resulting in incomplete emptying or drainage. Remove the grease by using hot or cold nitric acid, sulfuric acid-bichromate cleaning solution, or a good detergent.

A thin coating of paraffin rubbed on the ground surface of glass stoppers will prevent their sticking in bottles.¹¹ This is especially good for aqueous solutions of sodium or potassium hydroxide. It cannot be used for bottles containing alcohols, chloroform, xylene, benzene, ether, or oily substances.

Urine specimen bottles must be rinsed well after each use, and brushed with soapy water, or cleaned with sulfuric acid-bichromate solution frequently. Caution out-patients to use clean bottles when submitting urine specimens. Erroneous tests for sugar and other constituents of the urine may otherwise result. Poorly washed cosmetic and medicine bottles may contaminate urine, making it unsuitable for the use for Friedman and other tests.

When flasks used for the phosphorus determination are washed with a detergent containing phosphorus, we have found that the usual rinsing is insufficient. We rinse several additional times with phosphorus-free distilled water, and we also run blanks to determine if the rinsing process has been sufficient.

Flasks, bottles, and petri dishes contaminated with bacteriological material may be boiled, autoclaved, or soaked in a weak solution of cresol or lysol.

A strong solution of lysol will remove encrustations from the inside of stock staining bottles.¹²

Fine shot, or a length of small metal chain, may be shaken in flasks or bottles to loosen dirt.

Wittich¹³ emphasizes the importance of special cleaning methods for bottles and syringes used for allergenic preparations, since the glass may absorb and carry over from previous use, sufficient extracts to cause false reactions on highly sensitive individuals. His method for glassware includes brushing with a warm 1% solution of anhydrous tetrasodium pyrophosphate, pH 10.2, rinsing well in tap water, immersing in dilute HCl, rinsing in tap and distilled water, and sterilizing in an oven at 500° F. for 1 hour. Syringes are rinsed in hot running tap water, wrapped in a special case made of heavy duck, and sterilized in an autoclave at 20 lb. pressure for one-half hour.

Frozen syringes may be loosened in several ways. A metal opener may be used which applies gentle gradual pressure with warm water, on the frozen plunger. Placing the chilled syringe in warm water will expand the barrel.¹⁴ If clotted blood is present, boil in 25% glycerine before attempting this method. Hot glycerine alone may be sufficient. Soaking in cold nitric acid may take several days, but there is less danger of breaking the syringe than in some methods. Rubber tubing wound around both the head of the plunger and the barrel will allow a firm grip on the syringe, making loosening easier. Soaking in concentrated urea solution is also recommended.

Special long brushes are made for the mechanical cleaning of burettes. Also pipe-stem cleaner may be useful. A brush maker will make special brushes to fit micro-burettes.¹⁵ A diameter of $\frac{1}{2}$ inch and a length of 2 feet is good.

Burettes may be cleaned with suction. Small burettes may be immersed in various cleaning solutions in long test tubes. Bock¹⁶ has described a special flask for the final rinsing of burettes using a specially designed wash-bottle arrangement. The cleaning and rinsing solutions may be allowed to drain through the burette and the burette inverted to drain.

Commercially available mechanical devices, working on the principle of gradual application of pressure or tension on the

glass joint, may be used to loosen frozen stop-cocks.¹⁴ Gentle manual pressure may also help. Scovern advocates the use of a freezing mixture of cracked ice to chill a frozen stop-cock. Then with hands warmed with hot water, gentle pressure may be applied to loosen the cock. He states that this method eliminates cut hands and fingers, which may result with the use of marketed stop-cock pullers. He states that stop-cocks frozen with alkalis will not loosen with any method. Tapping lightly on all sides with a glass stopper of about the same size and weight as the frozen stopper may help.

Stop-cock lubricants and greases should reduce to a minimum the occurrence of frozen stop-cocks. These are available commercially, or they may be made in the laboratory. Kolmer gives a formula for a special stop-cock lubricant for use in the Van Slyke blood gas apparatus. Leave this apparatus partly filled with water, or with a weak soap solution, when it is not being used.

Commercially available washers for chemistry and bacteriological pipettes are available. These work on a siphon principle, and are attached to the water supply. Acid resistant metal carriers for the pipettes may be immersed in acid cleaning solutions. These same carriers serve as draining, drying, and storage containers.

Wise,¹⁶ and Boehm and Myers,¹⁷ have described home made pipette rinsers based on the siphon principle. A water suction pump may be used to draw cleaning fluids through pipettes and to dry them.

Glass wool at the bottom of a tall cylinder will protect the tips of pipettes. Cleaning and rinsing solutions may be poured on and off the cylinder full with pipettes. Some caution must be used to prevent the pipettes falling when the solutions are being decanted.

Pipettes may be dried in a hot air oven at 160° C. or they may be dried at room temperature. An inverted wire test tube basket may be used to drain chemistry pipettes. Metal and wooden racks are available commercially for draining pipettes. Pipettes which do not drain well and dry soon, at room temperature, are not chemically clean.

Foy¹⁸ tells up about the adaptation of an ordinary electric hair drier to make a drier for chemistry and serological pipettes. A nozzle fitted to the end of the blower and also fitted with a cork having holes to hold the pipettes, makes the apparatus suitable for this purpose. Only a few seconds of hot air, followed by a few seconds of cold air, are sufficient to dry pipettes which have been rinsed with acetone.

Traces of grease on pipettes may be removed by immersing

for a few hours in cold sulfuric acid containing about 10% by volume of nitric acid.

Hematological pipettes are usually cleaned with a water suction pump, using water, alcohol, ether, and air, or water, acetone and air. When the pipette is dry, the bead should move freely. Do not blow to dry, as moisture from the lungs will condense in the bulb, and cause inaccurate results. Petroleum ether may be used instead of ether.¹⁹ It is much cheaper, but must be used with caution, as it is highly inflammable. Autoclaving pipettes,²⁰ or drying them in a hot air oven at 200° F. for one hour,²¹ will eliminate the use of drying reagents.

A thick walled rubber bulb of a size to fit the hand may be attached to the pipettes to suck up, and to discharge the cleaning fluids.²² The fluids may then be used at least twice. Pipettes with albuminous encrustations in the bulb or stem may be cleaned by soaking in one of the following solutions: commercial hypochlorite solution, nitric acid, antiformin, trisodium phosphate, pepsin and 4% HCl, sulfuric acid-bicarbonate cleaning solution, or a solution containing 5 grams sodium carbonate, 0.5 gm. pancreatin, and a few drops of chloroform in 1000 c.c. water.

We pack hematological pipettes vertically in a beaker and fill the beaker with sulfuric acid-bichromate cleaning solution. The acid will rise, filling the pipettes, if the level of the acid solution is below the tips of the pipettes. Since the acid might harm our suction pump, we discharge the acid from the pipette with an arrangement consisting of a small rubber bulb attached to a short tapered piece of glass tubing, at the end of which is a short piece of thin rubber tubing.²³

Horse hair, or very fine wire, will help clean the stems of dirty pipettes. Use special caution to avoid chipping the tips of the pipettes.

New hematological counting chambers should be washed with soap and water, rinsed with distilled water, and dried in the air, or wiped with lens paper, cleansing tissue, or a soft cotton cloth. Linen or gauze may scratch the highly polished surfaces.

Alcohol and ether may be used with care to remove oil. A camel's hair brush may be used to dust off the counting chamber. A few drops of a supersaturated solution of sodium bicarbonate will help to remove material that has dried on the counting chamber.²⁴

Cleaning processes for used slides must be economical, both in time consumed and in the chemicals used. Otherwise the cost of cleaning may exceed the original cost of the slide. New slides should be boiled in soapy water, soaked in cleaning solution, rinsed, washed in 70% alcohol, dried, and polished. Used slides may be boiled in 5% sodium bicarbonate, washed with soap,

soaked in sulfuric acid cleaning solution, rinsed, and wiped out of 95% alcohol. A final rinse in ether speeds drying. Soaking slides in a weak nitric acid solution, or lysol will soften old balsam. Xylol followed with alcohol will help to clean slides having immersion oil or balsam.

Concentrated commercial products are available and may be diluted for use. Many of these are especially good for removing cedar oil, stains, grease, and blood from slides. A cleaning solution suggested for use in cleaning slides and coverslips is made by diluting 2 parts of glacial acetic acid with 100 parts of alcohol. Slides may be cleaned with Bon Ami, if they are polished well. As a time-saving measure, slides that have been soaked in sulfuric acid-bichromate cleaning solution, and have been well rinsed, may be allowed to drain without wiping.

Serological slides having wax or paraffin rings should be immersed in distilled water immediately after use, to prevent drying of the sera on the slides. Dry at room temperature, or use a soft lint-free cloth. The slides may be used indefinitely without replacing the wax or paraffin.

One authority suggests preparing slides for use for reticulocyte counts by using Bon Ami, and polishing. A final brushing is done with a camel's hair brush that has been washed in ether, and has been well dried. Several references were found which stressed the importance of using special care in cleaning slides to be used for the diagnosis of malaria.

Be sure that coverslips, to be used for making blood films, are clean. After soaking in a sulfuric acid-bichromate cleaning solution for 24 hours, they may be rinsed well and are kept in 95% alcohol until dried for use. They may be dried by being rubbed gently over a board padded tightly with a clean linen towel. Handle slips with forceps and store in a dust-proof box.

May I make a final suggestion concerning facilities for washing glassware. In planning a new laboratory or remodelling one, make provision for enough sinks and drain boards. Even with improved methods and special equipment, cleaning processes take a certain amount of time. Money spent for any improvements that can be made in the arrangement of the laboratory will be well spent.

As a rule workers like to devise their own short cuts to speed the processes involved in the washing of glassware. If they are allowed this privilege, their ultimate speed will be greater, because their own methods are more natural for them. However it is the duty of the supervisor of the washers of glassware to observe their methods, and to decide if a few suggestions, here and there, are advisable, so that the worker does not omit im-

portant steps in the procedures, and will ultimately become more efficient in her work.

In conclusion, may I urge you to analyze your own methods? Decide if your methods are doing the work efficiently and economically, both as to the use of cleaning agents, and as to the use of time. Don't change methods just to be changing, but do change, if other methods will be better.

SUMMARY

1. General methods for the mechanical and chemical cleaning of laboratory glassware have been presented.

2. Special methods have been given for cleaning test tubes, bottles, flasks, pipettes, burettes, syringes, slides and coverslips.

I wish to acknowledge assistance from Dr. J. P. Tollman, Ruth Pohle, Ruth Nelson, Carolyn Lippke, Ruth Grimes, Frieda Claussen, Mary Fox, and Ramona Forbes.

Much valuable information was obtained from the following sources:

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RECENT DEVELOPMENTS IN SPECIAL STAINING TECHNICS*

By MARY FRANCES GRIDLEY

Histopathology Laboratory, Army Institute of Pathology

Certain new developments in special staining technics have been found of value and adopted at the Army Institute of Pathology during the last few years. It is the purpose of this paper to review a few of those in most common use in our histopathology laboratories.

The silver stains, as a general rule, are considered among the more difficult to perform. Results are often inconsistent, even though glassware is chemically clean and solutions accurately prepared. The stains for *Treponema pallida* in tissue sections have been tedious and time consuming.

In 1905, Levaditi¹ published a method for staining spirochetes in a block of tissue. Impregnation by silver nitrate reduced by pyrogalllic acid and formalin was the basic principle involved. The biggest disadvantage to the Levaditi method is the use of the block of tissue. In cases where a small biopsy is taken the tissue must be embedded and routine preparations made. The block then has to be deparaffinized, rehydrated, and impregnated with silver. This takes from eight to ten days or longer. Results may be inconsistent since the spirochetes in sections taken from the surface of the block may be more intensely stained than those near the center.

Warthin and Starry,² in 1920, devised a method for *Treponema pallida*, using a paraffin section on a coverslip. From time to time this method has been modified and at present the one that probably is most commonly used is that described by Kerr³ in a publication of 1938. Briefly, this method consists of impregnation in silver nitrate and development in a mixture of gelatin, silver nitrate, and hydroquinone. Its disadvantages are the use of coverslips instead of slides, the impermanence of the stained sections, and the tendency of nerve fibers to stain which makes the search for spirochetes more difficult.

A method for staining a single section mounted on a slide was presented by Dieterle,⁴ in 1933. The technic involves sensitization in uranium nitrate, impregnation with silver nitrate, and development in a solution composed of hydroquinone, sodium sulfite, formaldehyde, acetone, pyridine, and gum mastic. This method is difficult for the inexperienced, as well as unpleasant to carry out because of the use of pyridine and gum mastic.

Dr. Maduriera Para,⁵ of Rio de Janerio, worked out a new

* Paper presented at American Society of Medical Technologists, St. Paul, Minnesota, June 7-9, 1948.

stain for spirochetes which he published in 1946. His method is simple, yet gives accurate results. Paraffin sections of tissues 4 to 6 microns in thickness, are prepared on slides. Briefly, the technic consists of mordanting in uranium nitrate, impregnation in silver nitrate, with subsequent sensitization in a colloidal suspension of silver nitrate and lithium carbonate. Reduction is completed in Levaditi's reducing solution. Spirochetes are stained black on a yellow-brown background.

Dr. Para has also worked out variations of this technic to increase its practicability. Substitutes for the mordant, uranium nitrate, are: 4% aqueous ferrous ammonium sulfate, sulfur water, 1% oxalic acid, 0.5% aqueous copper sulfate, or a 1 to 5000 dilution of potassium permanganate. Colloidal silver tartrate or ox bile and rosin may be substituted for the sensitizer. Hydroquinone may be used in place of the formaldehyde-pyrogalllic acid reducing agent.

We believe that the Para stain is more adaptable for routine use in a laboratory than the Levaditi, Dieterle, or Warthin-Starry, since most of the solutions can be kept on hand for immediate use, the time element is moderate, and the stain can be done on a paraffin section mounted on a slide.

The Feulgen⁶ reaction with its many modifications has been found of value in the laboratory. This chemical reaction was adapted in 1924 from the Schiff reaction for aldehydes and is considered specific for nucleic acid. Dempsey and Wislocki,⁷ in an article entitled "Histochemical Contributions to Physiology," cited the reaction on nucleic acid as an example of what can be done in the field of physiologic histochemistry. Perhaps the day is not far off when every tissue element can be stained by a specific chemical reaction.

The thymonucleins are nucleoproteins composed of a large molecule which contains a protein conjugated with nucleic acid. The two most common nucleic acids are desoxyribonucleose and ribonucleose. Feulgen originally used normal hydrochloric acid as a hydrolizing agent. After mild hydrolysis of the nucleic acid, the resulting protein has acidophilic properties. Coleman,⁸ in 1938, modified the Feulgen reaction by hydrolysis in normal hydrochloric acid at 60° C., followed by immersion in leuco-fuchsin and differentiation in sulfurous acid rinse. He suggested fast green as an alternative counterstain. Chromatin is stained somewhat bluish red by this method. The chromatin of plasmodia, sarcosporidia, histoplasma, and some yeasts is Feulgen positive. Helen Wendler Dean,⁹ in 1945, reported staining primate malarial parasites by this technic.

Bauer,¹⁰ in 1933, modified the Feulgen reaction by using chromic acid as a hydrolizing agent, staining in leuco-fuchsin, fol-

lowed by three changes of sulfurous acid. This method stained glycogen and mucin. Caroline Bensley,¹¹ in a comparison of microscopic methods for staining glycogen, found that Best's carmine, iodine, and Bauer's modification of the Feulgen reaction gave comparable results after proper fixation, i.e., nine volumes of absolute ethyl alcohol to 1 volume of 40% neutral formaldehyde.

In 1946, J. F. A. McManus,¹² during the course of an investigation for the histochemical uses of periodic acid, found that Schiff's reagent following periodic acid stained mucus of the goblet cells of the human intestine and bronchus, mucous salivary glands, colloid of thyroid and pituitary stalk, certain pituitary cells, the basement membranes of the tubular epithelium and of the glomerulus of the kidney.

The McManus technic has been enlarged and altered for use in the laboratory of the Army Institute of Pathology. Periodic acid is used in hydrolizing tissue. After immersion in leucofuchsin and differentiation in sulfurous acid the nuclei are stained with alum hematoxylin and the background lightly counterstained with metanil yellow. The metanil yellow makes a contrasting background for the bluish red color of the positive Feulgen reaction.

Amyloid, a chondroitin sulfuric acid protein complex, exhibits metachromatic staining with certain basic dyes. It is colored mahogany brown by Mallory's¹³ iodine reaction. This preparation is not permanent since it must be mounted in water or glycerol. Langhans¹⁴ made permanent mounts by staining with carmine and Gram's iodine solution, clearing and mounting in origanum oil.

Bennhold,¹⁵ in 1922, stained amyloid in 1% aqueous Congo red, immersed in lithium carbonate, decolorized in 80% alcohol, washed, counterstained with alum hematoxylin, washed, dehydrated, cleared and mounted in clarite. Amyloid stains red, nuclei blue.

In 1946, Highman¹⁶ varied Bennhold's Congo red method by differentiating in 0.2% potassium hydroxide in 80% alcohol, rinsing and mounting in water or glycerol.

Mallory used 1% crystal violet in 80% alcohol solution, differentiated in 1% aqueous acetic acid, washed thoroughly in tap water, and mounted in water, glycerol, or Apathy's syrup. Highman also stained in 0.5% to 1% crystal violet or methyl violet in 2.5% acetic acid, washed, and then mounted in modified Apathy's gum syrup. Amyloid and cartilage and certain types of mucus stain reddish purple.

In 1947, Lieb¹⁷ used 0.3% crystal violet and made a permanent

mount in abopon, a water miscible plastic mountant, which has proved most satisfactory.

Fatty acids stain from pink to purple with nile blue sulfate. However, when mounted in glycerine jelly or levulose the stain diffuses out through the tissue and fades rapidly. Glycerin jelly also changes the blue color to a greenish blue which is undesirable.

We have devised the following method. Stain frozen sections in a saturated aqueous solution of nile blue sulfate for 20 to 30 minutes. Rinse in water. Differentiate in 1% acetic acid and wash for 2 to 4 hours in several changes of water. Mount in abopon. We have slides which we have kept for a period of six months and there has been no fading or change in color. Slides mounted at the same time in glycerin jelly have lost all differential staining qualities. We are of the opinion that abopon is a satisfactory permanent mount for nile sulfate stain.

Several water miscible plastic mountants have come into the market and we are working with a number of them in an endeavor to find a permanent mounting agent for stained material that now must be mounted in water or glycerol.

Masson's trichrome stain¹⁸ has been used extensively for differentiating connective tissue and muscle fibers. The original stain technic called for acid fuchsin, Ponceau de xylinde, orange G, and aniline blue. During the war years it was impossible to procure Ponceau de xylinde, a French dye, so it became necessary to find a substitute. Dr. R. D. Lillie¹⁹ has suggested Biebrich scarlet, Bordeaux red, or chromotrope 2R. We have found the Biebrich scarlet most acceptable. When it is used, a mixture of phosphotungstic and phosphomolybdic acid is substituted for phosphotungstic acid as a differentiating agent. Fast green or wool green may be used instead of aniline blue if the green counterstain is preferred.

There have been many other developments in special staining technics. It would not be possible to discuss them all. Many are of value only in laboratories doing highly specialized examinations and research. Those discussed here are applicable to any laboratory since they do not require the use of expensive equipment or reagents.

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(Continued on Page J)

ABSTRACTS

SEROLOGY

FURTHER STUDIES ON THE WELTMAN SERUM COAGULATION REACTION. By Leo H. Siegel, M. D., and Manfred Kraemer, M. D., Presbyterian Hospital, Newark, N. J. *Jour. Lab. and Clin. Med.* 33:618 (May) 1948.

The authors feel that this test has considerable value in indicating the presence of exudative or inflammatory disease of the gastro-intestinal tract, including neoplastic lesions when the latter are accompanied by ulceration and exudation.

A modification for the Weltman reaction is given.

Technique:

Ten test tubes are set up in a rack and are numbered 1-10 from left to right. Add 5 ml of 0.1% solution of calcium chloride ($\text{CaCl}_2 \cdot 6\text{H}_2\text{O}$) to tube #1. Decrease by 0.5 ml amount pipetted in each tube and pipette correct amount in the other 9 tubes. Bring the volume in each tube up to 5 ml with distilled water. To tube 10 is added 4.5 ml water; to tube #9 4 ml, water; to tube #8 3.5 ml, etc—tube 2 will get 0.5 ml water. The calcium chloride solution has been diluted in dilutions ranging from 0.1% in tube #1 up to 0.01% in tube #10.

Add 0.1 ml of fresh unhemolyzed serum to each tube. Shake tubes, then place in a boiling water bath for exactly fifteen minutes. After removing tubes from water bath, record the numbers of the tubes in which coagulation has taken place. Normally coagulation takes place in the first six tubes, not in tubes 7-10. The coagulum appears as a flocculation. Care must be taken in determining the tube in which actual coagulation has occurred. The Coagulation Band or Weltman is expressed by the number on the tube containing the most dilute solution of calcium chloride in which coagulation has occurred.

When the coagulation band is less than 5, it is said to be a shift to the left, if more than 7, it is said to be a shift to the right.

The authors found that significant results seem to be confined to those cases showing a left shift, and that when 4 or less, usually indicates, in gastro-intestinal complaints, an inflammatory lesion of serious import and that it readily reverts to normal when this lesion is healed or removed.

CHEMISTRY

Sols. A.

1947. **Determinación directa de colesteroína total en suero.** (Direct determination of total cholesterol in serum.)

R. esp. Fisiol., 3, 225-241.

A specific method for the determination of serum cholesterol of the greatest simplicity is proposed. Serum is treated with acetic anhydride which changes the water into acetic acid and the cholesterol (both free and

612. 123: 545. 8.

sterified) into cholesteryl acetate. The proteins precipitate and adhere to the walls of the tube. Cool and decant into another tube. Sulphuric acid is added and the green colour is evaluated with the aid of a standard cholesterol solution in acetic anhydride simultaneously treated, with occasional deduction of the colour of the extract in case of hyperpigmented serums.

REAGENTS

Acetic anhydride. Concentrated sulphuric acid.

Standard cholesterol solution. 19.3 mg. of cholesterol and 8.8 ml. of water are treated with about 200 ml. of acetic anhydride in a boiling water bath for 15 minutes, cooled and made up to 250 ml. with acetic anhydride. Keep in a dark brown glass-stoppered bottle.

Revista espanola de Fisiologia

PROCEDURE

0.2 ml. of serum and 5 ml. of acetic anhydride are mixed and shaken gently in a test tube of about $6 \times \frac{3}{8}$ inches. The tubes are placed in a boiling water bath in an inclined position so that their mouths are out of the steam. After 20 to 30 minutes cool in tap water (8 minutes are sufficient). Then each tube is inclined carefully so that the liquid may be decanted completely into another tube, the proteins remaining undisturbed.

Place in another tube 5 ml. of standard cholesterol solution.

To each tube are added 0.15 ml. of sulphuric acid, thoroughly mixed and placed in tap water.

Standard and unknowns are compared, using a red-orange filter (optimum 620 m μ), after about 45 minutes (not less than 30 minutes and not much more than 1 hour).

Calculation: $\frac{EU \times 200}{ES}$ or $\frac{RS \times 200}{RU} = \text{mg. of cholesterol per 100 ml. of serum.}$

With hyperpigmented serums (icteric or markedly haemolyzed) the extracts have before the addition of the sulphuric acid a colour which must be subtracted (multiplying by 1.4 if it be icteric) from the apparent final value. In the case of coincidence of icterus and haemolysis use a violet filter (optimum 450 m μ) and do not employ any factor.

Normal values: 170 to 240 mg. per 100 ml. of serum.

IN MEMORIAM

A. S. M. T. Members—1948

Helen Buehrle, 1542 Elm St., Youngstown, Ohio.

Mrs. Florence Lydia Arkless, 7221 Madison St., Forest Park, Illinois.

Mr. Arthur Elbert Ballentine, 1319 North Broadway, Baltimore, Maryland.

Mrs. Ethel Behlen, 2706—19th St., Columbus, Nebraska.

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Jane Sarah Welch, 1225 P. Street, Lincoln Nebraska.

A. S. M. T. AND UNESCO

"Preamble to the Constitution of the United Nations Educational Scientific and Cultural Organization:

"The Governments of the states Parties to this Constitution on behalf of their peoples declare that since wars begin in the minds of men, it is in the minds of men that the defenses of peace must be constructed;"

The above portion of the preamble to the Constitution of UNESCO might be said to have been the theme of the meeting of the U. S. Commission for UNESCO at Boston last month.

Perhaps it would be well to answer some of the questions which we know exist in the minds of many who will read this report. With due respect to those who have presented this information to our group, we shall quote from one of the learned members of the Commission who is aware of the apathy on the part of many citizens toward UNESCO—"Far too many persons think a new cracker has reached the market when they hear UNESCO—"

The basic objective of UNESCO (United Nations Educational, Scientific and Cultural Organization) is to seek peace and security through international understanding. The U. S. Commission of UNESCO (which acts in an advisory capacity to the Department of State) is made up of one hundred men and women, forty of whom are selected for the contribution they as individuals can make and sixty of whom are selected by the national organization they represent. The members of the Commission are chosen for a three-year term and are eligible to serve no more than two terms consecutively. This enables representation on the Commission to rotate constantly.

Many organizations work voluntarily with UNESCO. They may do so "by cooperating with the National Commission—at all times through exchange of information, continuing support for UNESCO objectives and sharing of services, experts and facilities; by collaborating with Government agencies; by undertaking specific assignments, separately and in collaboration with similar groups in the United States and in other countries."

It appears that here is where A.S.M.T. may fit into the UNESCO program—a cooperating organization. This, of course, is a matter for the Society to decide.

UNESCO's program is divided into six sections—Reconstruction, Communications, Education, Cultural Exchange, Human and Social Relations and Natural Sciences—all coordinated so as to have a unity of effect, that is, to contribute to peace and security through international understanding. Of these, Reconstruction received special emphasis. The section recommended that organizations develop practical projects as a means of edu-

cational reconstruction in war devastated countries. Some of the other highlights of the program for contributing to understanding are: exchange of persons, promotion of production, distribution and use of films and radio broadcasts on subjects related to its aims, development of public libraries as centers of popular education, improvement of standards of education at all levels, development of a plan for improvement of textbooks and teaching materials as aids to international understanding; promotion of international cooperation in the theater, establishment of an international pool of literature, provision for a world center of scientific liaison.

Some of the readers of this journal may think that they are already too busy to take on any additional problems or projects. We appreciate that feeling. We appreciate, too, that peace is everyone's business. It is the sacred duty of every individual to make a real effort to contribute to peace.

On the closing day of the meeting of the U. S. Commission for UNESCO, a general discussion was held on the subject "How Can UNESCO Contribute to Peace?" The Honorable Archibald MacLeish made the opening statement for this discussion and it is one of the most moving and thought-provoking statements that this observer has had the privilege to hear. Mr. MacLeish pointed out that, "The 'cold war' is not a 'war' soldiers know how to fight or diplomats know how to control. It is, on the contrary, as the Russians realize and almost daily confess, a 'war' on a battlefield where physical weapons have little power and the techniques of diplomacy are altogether useless. It is a 'war' of which the battlefield is men's minds—the minds of all men everywhere—and in which the weapons are the things by which men's minds are moved. It is, in other words, precisely such a war as the Constitution of UNESCO, not the textbooks of the war colleges and the examples of the foreign service schools, foresees."

Continuing his statement on "How UNESCO can contribute to peace, Mr. MacLeish stated, "If UNESCO, forgetting the literal legalities of its status, will regard itself not merely as the agent of its member governments, but as a kind of trustee, in this time of world political bankruptcy, for those human values which have been committed to its charge; and if it will use all the intelligence and all the tools it possesses to declare and to define the vast and tragic human experience which underlies all the dogmas and the doctrines and the ideologies—if it will use the great Word of art and science and the powerful instrument of education to remind men everywhere that the question they must answer, not only in Russia, not only in France, but here as well, and everywhere, is the same question for us all, UNESCO

may well break the paralysis of the 'cold war,' the war of inevitable disasters, the war of numb despair, where and where alone that paralysis can be destroyed."

—Ida Reilly

Editor's Note: Miss Reilly attended the meeting of UNESCO in Boston, Massachusetts, on September 27, 1948, as an observer for our organization. The above is her report.

WHY NOT EIGHT THOUSAND MEMBERS BY 1949?

The membership committee is charged with the great task of promoting membership in the American Society of Medical Technologists and the various state societies. Yet a committee of six persons, however active and willing, cannot accomplish this goal alone. We need *your* help.

The efforts of each and every member are necessary to extend our membership to all qualified persons. There are over 12,000 registered medical technologists and many persons holding advanced degrees who are eligible for membership in the American Society of Medical Technologists. Don't you know at least one, maybe several, technologists whose interest and qualifications would make them valuable assets to our organization? Can *you* accept the responsibility of at least doubling our membership by just these persons?

Will your state have a total membership large enough to send the maximum quota of delegates to our next annual convention? Which state will be the first to have all of its registered technologists belong to both A.S.M.T. and the state society? Which state society will have as members the largest number of persons with advanced degrees? It's up to you!

Are you an A.S.M.T. member, but not a member of your state society? Why? Have you just neglected to join? Your state society needs you, and you need your state society. Your national membership is now suspended if you do not become a member of your state group. It's up to you!

If your state does not have a state society, why not get busy and form one? Fifteen state groups started this way last year, and several more have affiliated since last June. The responsibility is yours!

The membership committee stands ready to aid, guide, and assist you in any way that it can. We want your suggestions and your criticisms. Together we can hope to greet the delegates of 8,000 members in Roanoke next June.

Jeanne Jorgenson, Membership Committee.

CONSTITUTION AND BY-LAWS COMMITTEE

The Constitution and By-Laws Committee wishes to remind the membership that proposals for amending the Constitution or By-Laws must be submitted to this committee for consideration. Material must be sent the members of the committee before January 1, 1949, in order that they may consider it carefully and reword, if necessary, to conform with the Constitution and By-Laws, and to prepare it for publication in the journal in the March issue.

It is requested that proposals submitted be accompanied by discussion of the reasons for possible acceptance. The committee will attempt to submit to the membership arguments pro and con for each proposed amendment. This should eliminate excessive debate in the meeting of the House of Delegates.

Please send your suggestions to the following committee members:

L. B. Soucy, Chairman, 204 S. E. Fifth St., Plainview, Texas.
 Kathleen Knippel, 3 College St., Montgomery, Alabama.
 Allyne Lawless, 3420 West 30th, Denver, Colorado.
 Sylvia Anderson, 8020 Wauwatosa, Milwaukee, Wisconsin.
 Mr. Elwyn Scott, Delaware Hospital, Wilmington, Delaware.

STANDARDS AND STUDIES COMMITTEE

This past spring the Standards and Studies Committee mailed questionnaires to all A.M.A. approved hospitals and all doctors' offices known to employ medical technologists. These returns are still coming to the committee which is now mailing the questionnaires to all commercial, pharmaceutical, drug company, and research laboratories, and to any other laboratory to which their attention is called. You can help them by sending in the names of any laboratories of which you know and which have not yet received the questionnaire. Mail these names and addresses to the committee member assigned to your state.

Charlotte Taw, South Side Hospital, Pittsburgh, Pennsylvania: Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, Pennsylvania, New Jersey, and Delaware.
 Doris Boon, Box 3149, Charleston, West Virginia: Maryland, Virginia, West Virginia, Kentucky, Tennessee, North Carolina, South Carolina, Mississippi, Alabama, Georgia, and Florida.
 Sister M. Dolorosa, 1325 S. Grand Blvd., St. Louis 4, Missouri: Michigan, Illinois, Indiana, Ohio, Missouri, Arkansas, Iowa, and Louisiana.
 Margaret Miller, 629 Thacker Bldg., Pueblo, Colorado: Washington, Oregon, Montana, Idaho, Wyoming, Nebraska, South Dakota, North Dakota, Minnesota, Colorado, and Wisconsin.
 Barbara Isbell, 4781 Santa Cruz, San Diego 7, California: California, Nevada, Utah, Arizona, New Mexico, Kansas, Oklahoma, and Texas.

Mollie Hill, Chairman, 4620 Hunt Ave., Chevy Chase 15, Md.

NOMINATIONS AND ELECTIONS COMMITTEE

The Nominations and Elections Committee wishes to call attention to the list of officers to be elected at the next annual meeting of the American Society of Medical Technologists. The committee has notified all affiliated societies by letter to the secretaries to send in their selections for these offices. The members of the committee would also appreciate any suggestions from individual members of the society. NOW is the time to voice your opinions as to whom you would like to have nominated for these positions. All requests will be given the committee's closest attention. ALL SUGGESTIONS MUST BE IN THE HANDS OF COMMITTEE MEMBERS BY DECEMBER 1, 1948.

The offices to be filled and those now holding these offices are as follows:

President-elect: Ida Reilly.

Recording Secretary (subject to re-election): Vernal Johnson.

Board of Directors (three-year term): Rose Matthaei.

—Henrietta Lyle

It is important that we have the names and qualifications of the proposed candidates from those who best know their qualifications. They must be members of the American Society of Medical Technologists in good standing and must have been members for at least two years.

Send communications at once to any member of the committee or to the chairman:

Henrietta M. Lyle, Washington County Hospital, Hagerstown, Md.; or
Maple Manor, RD No. 2, Columbia, Penna.

Gladys Jacobs, 212 Garfield St., Bay City, Mich.

Eunice Reinhardt, St. John's Hospital, Springfield, Illinois.

Clara Kruse, P-33 University Village, 28th & Como Ave., Minneapolis 14, Minn.

Hazel Current, 918-17th St., Santa Monica, California.

Frieda Claussen, 469 Laurel Ave., St. Paul, Minn.

THE EDUCATION COMMITTEE SPEAKS

On the Subject of Recruiting Medical Technologists Through the Coordinator of Vocational Guidance and Recruitment

The A.S.M.T. has felt the keen need of well-trained medical technologists and has decided to sponsor a nation-wide campaign to recruit suitable students for our approved training schools. Several states have already been quite successful with their efforts along this line and would like to share some of their ideas with all A.S.M.T. members.

The Oklahoma Society prepared a very attractive poster entitled, "Be a Medical Technologist," with an interesting picture of a medical technologist at work. At the bottom of the poster

names and addresses of sources of further information were given. Each high school principal in the state received one of these posters, together with an explanatory letter requesting him to post on the bulletin board. There were many inquiries as a result of these efforts. This same organization also was responsible for the profession of medical technology being represented on the annual Career Conference program of the University of Oklahoma. Mrs. Lucille Wallace was the speaker and counsellor for our profession on that occasion.

Colorado Society has sent some of their members to speak on high school Career Day programs and has obtained names of interested students from class advisors. These students were then sent personal invitations to attend an "open house" meeting at the Colorado State Hospital Laboratory. These personal contacts were very effective.

The Chicago Society organized a publicity campaign last year, dividing the city and suburbs into five districts, each of which had a chairman. These chairmen contacted vocational guidance directors in the public and private high schools and colleges for personal interviews to explain the profession and required training. They also provided speakers for Career Day programs and science clubs. A detailed outline of a suitable talk was prepared by one of the members and copies were given to each one volunteering for the speaking appointments. The outline contained details regarding academic requirements, personal qualifications, opportunities, and a list of schools in the Chicago area. Literature was obtained from the Registry at Muncie, Indiana, for distribution to interested students. Copies were also placed in the vocational guidance files of the public library.

Indiana is planning an exhibit and information booth on medical technology for their State Fair. Through this it is hoped to reach many of the 4-H girls from rural areas.

A description of the work done by the Harris County (Houston, Texas) Society of Medical Technologists appeared in the January, 1948, issue of the journal (page 29).

Material presented by Miss Feucht, coordinator of Vocational Guidance and Recruitment, A.S.M.T.

Details regarding the handling of publicity by feature stories in newspapers and newspaper interviews may be had by writing the Executive Office, Lafayette, La., Medical Center Bldg.

For further information on the projects described, write:

Miss Lavina B. White, 306 W. 18th St., Pueblo, Colorado.

Mrs. Dorothy Foreman, Tahlequah City Hospital, Tahlequah, Oklahoma.

Mrs. Ruth Feucht, 1142 East 55th St., Chicago 15, Illinois, Coordinator of Vocational Guidance and Recruitment.

RESEARCH COMMITTEE**An Open Letter to the Membership of the A.S.M.T.**

Dear Fellow Members:

In identifying the Research Committee and its activity I would like to tell you briefly of its function and plans.

The standing committee, composed of Medical Technologists, offers to you a consultation service, in several scientific fields. This service comprises, at the present time, the following subjects: Serology, Bacteriology, Chemistry, Parasitology, Hematology, Mycology, Statistics and Graphic Presentation. Additional subjects are being added and will be announced later. Inquiries on the above subjects should be directed to the respective members of the committee as follows:

Miss Dorothy Hitchcock (Parasitology) Department of Bacteriology, Michigan State College, East Lansing, Michigan.

Mrs. Hazel Sussenguth (Serology), 1883 East 101 Street, Cleveland 6, Ohio.

Mr. Hartzell G. Payne (Chemistry), Research Department, Commercial Solvents Co., Terre Haute, Indiana.

Miss Joyce Humphrey (Hematology), 4933 Buckingham Court, St. Louis 8, Missouri.

Miss Elizabeth O'Toole (Bacteriology), University of Colorado, Department of Bacteriology, School of Medicine, Denver, Colorado.

Forrest W. Cross (Mycology Statistics & Graphic Presentation), Office of Field Studies, Tuberculosis Control Division, U. S. Public Health Service, Washington 25, D. C.

During the past few months special consultants have been obtained and the committee is exceedingly grateful for their offer to act in this capacity. They are: Dr. Carroll E. Palmer, specialist in the field of Medical Statistics and Tuberculosis; Mr. Edward S. Weiss, Bio-Statistician; Miss Jennie C. Goddard, Graphic Specialist; all of the U. S. Public Health Service, and Dr. Arden Howell, Jr., Associate Professor of Mycology, Duke University School of Medicine, Durham, North Carolina.

While the fields of statistics and graphic presentation are relatively new to some technologists, these subjects are not to be slighted, and we are very fortunate in obtaining the assistance of these professional persons.

Another function of this committee is the establishment of a research project. The research fund at the present is limited to \$150.00 for the project to be selected. However, other sources are being investigated for obtaining financial assistance. The members of the Society are invited to request applications for projects and to submit the applications for evaluation and selection by the Committee. While the proposed project will not be limited to any particular subject, or item in Medical Technology,

priority will be given in the selection on the merits of the proposed subject and the value of information derived therefrom by the Society members at large.

In the event that State or local societies possessing a research committee are considering the initiation of a research project, these societies are also invited to participate in the formulation of a joint project with the A.S.M.T.

To the members of state societies who desire to form a research committee, your national committee welcomes your inquiries and will assist in any way possible.

Forrest W. Cross, Chairman, Research Committee.

EDUCATION COMMITTEE

Dear Fellow-Medical Technologists:

Once again we are urging you to prepare a paper for the annual Convention. This year it is to be held in Roanoke, Virginia. If you cannot prepare a paper, perhaps you can assist in the scientific discussion of one.

If you are writing a paper now, notify the chairman, as it will most certainly help with the program. Give her your subject and she can place it on the tentative program.

Be prepared for discussion of your paper for often many benefits come from questions asked from the audience. If you care to prepare questions previous to the reading, that is desirable.

We hope that we will be as successful in gathering material as the previous committee. Let's get started NOW!

Sister Mary Antonia, Chairman, Education Committee.

RULES FOR WRITING SCIENTIFIC PAPERS

1. Those individuals competing for A.S.M.T. awards **MUST** be active members of the American Society of Medical Technologists. If you are not a member join the A.S.M.T.
2. All papers become the property of the American Society of Medical Technologists and are usually used in journal publication. So by writing a paper you not only benefit the individuals attending the annual meeting but those not attending.
3. Five copies of the paper must be submitted to the program committee chairman. These papers must be typewritten and double spaced on regular size typewriting paper; also use wide margins.
4. The time limit on the paper reading shall not be more than 20 minutes, exclusive of showing slides. All equipment for all types of slides will be furnished, and professional technicians will operate such equipment. Please indicate to the chairman what type of equipment will be necessary.
5. Papers selected for the Roanoke Convention Program must be read in person or by proxy at convention time.
6. Deadline for papers to reach the chairman is January 30, 1949.
7. Mail all papers to Miss Mary Eichman, Chairman of Convention Program Committee, 440 Lyceum Avenue, Philadelphia 28, Pennsylvania.

STOP**LOOK****READ****FELLOW TECHNOLOGISTS**

If it is help you need:

1. In planning your monthly program
2. In obtaining material for your monthly program
3. In securing films or short educational features to keep abreast with this fast progressing field
4. In solving a technical problem

write your Education Committee. We don't promise the impossible, but we will try to find the answer if one is to be found.

WATCH THIS SPACE EACH MONTH

(If interested, note it—If not, forget it)

HEPATOGRAM**SUMMARY OF FUNCTIONS OF THE LIVER**

Functions*	Mechanism*	Laboratory Tests
Carbohydrate Metabolism	(1) Conversion of glucose into glycogen.	
	(2) Conversion of lactic acid into glycogen.	Galactose Tolerance
	(3) Storage of glycogen.	Oral and I. V.
* * * * *		
Protein Metabolism	(1) Deamination of amino-acids.	Total Protein
	(2) Production of urea.	Albumen
	(3) Production of fibrinogen.	Globulin
	(4) Formation of plasma albumen and globulin.	Cephalin Flocculation
	(5) Production of prothrombin.	Thymol Turbidity Takata Ara

* Kolmer, John A., "Clinical Diagnosis by Laboratory Examinations," First Edition—Revised D. Appleton—Century Company, 1944.

LEGISLATION COMMITTEE

If the work of the Legislation Committee is to be of any benefit to the membership of A.S.M.T., we must have the cooperation of members in all the states. Three things we want to know; all of them are very important to each state's membership. Attempts have been made to get in touch with members in each state, but that is difficult to do if we do not have the name of the state chairman of Legislation. If your chairman has not been contacted by a member of the Committee, please have that chairman contact us.

For the purpose of simplifying the exchange of information that we need, the national committee has divided the states among its members. Find your committee member below and write to the person who is trying to contact you.

Evelyn Jardine, Mary Hitchcock Hospital, Hanover, N. H.: Maine, New York, Vermont, Massachusetts, Connecticut, Rhode Island, New Jersey, and New Hampshire.

Wilbert Zimmer, Physician's Lab. Service, 327 E. State Street, Columbus 15, Ohio: Michigan, Pennsylvania, West Virginia, Maryland, Delaware, Virginia, Kentucky, and Ohio.

Grace Mary Ederer, Northwestern Hospital Lab., Minneapolis, Minnesota: Wisconsin, Iowa, Illinois, Indiana, North Dakota, South Dakota, Nebraska, and Minnesota.

Grace Marck, 2937 S. 52nd St., Milwaukee 14, Wisconsin: Washington, Oregon, Idaho, Montana, Wyoming, California, Nevada, and Utah.

Vondell Stewart, 3905 Day, Houston 6, Texas: Arizona, New Mexico, Colorado, Texas, Louisiana, Mississippi, Kansas, and Missouri.

Vernal Johnson, 1115 Medical Arts Bldg., Oklahoma City 2, Okla.: Arkansas, Tennessee, North Carolina, South Carolina, Alabama, Georgia, Florida, and Oklahoma.

If you state has not yet organized, it is especially important for you to be in touch with us. We would appreciate hearing from any of you, especially if you happen to reside in the capital of a state where there is no state organization. Really, good people, this is important to all of us!

When you write to us, you may be able to save one exchange of letters by telling us three things: (1) Whether or not your state organization is incorporated and if not, whether you have started the process; (2) the dates upon which your state legislature meets; and (3) whether or not there is a need in your state for licensure for technologists and if there is, we would like to know the reasons.

PLEASE see that your state is in touch with us this month.

Vernal Johnson, M.T. (ASCP), Chairman, Legislative Committee.

FINANCE COMMITTEE REPORT

Distribution of \$1325 Committee Fund

Education	\$ 500.00
Membership	350.00
Constitution and By-Laws.....	100.00
Standards and Studies.....	75.00
Research	150.00
Legislation	100.00
Nominations	25.00
Finance	25.00
Total.....	<u>\$1325.00</u>

HAVE YOU PAID YOUR DUES FOR 1948-49?

YOU WILL WANT YOUR NAME TO BE IN THE ROSTER TO BE PRINTED SHORTLY AFTER JANUARY 1, 1949! YOUR NAME WILL BE IN THE ROSTER ONLY IF YOU HAVE PAID YOUR DUES SINCE JULY 1, 1948. Send a sum equal to the amount of your state dues PLUS FIVE DOLLARS FOR YOUR A.S.M.T. DUES TO YOUR STATE TREASURER, whose name appears in the list elsewhere in this issue of the journal. If your state has no society, get in touch with the membership chairman. In those places where there are local or district societies of medical technologists, include those dues and send to your local or district treasurers. **PAY YOUR DUES NOW!** Your name will appear just as it does on the envelope of the journal. Please notify the Executive Office, Medical Center Bldg., Lafayette, Louisiana, IMMEDIATELY, of any error, and **SEND YOUR CORRECT ADDRESS.** The By-Laws of the A.S.M.T., Article III, Section 1, states that the "annual dues shall be payable on or before November 15." Section 2 continues with, "Any active member who fails to pay annual dues by January 15 shall be suspended from membership and may be reinstated upon payment of all dues in arrears, current annual dues and the sum of \$1.00 as a reinstatement fee to be paid this society."

PAY YOUR DUES NOW!**PROGRAM COMMITTEE**

In the face of a greater demand than ever before for laboratory service, we medical technologists who staff the laboratories and teach medical technology, find it highly important to keep abreast with what's new in laboratory medicine and medical technology. With this fact in mind, we invite each member of A.S.M.T. to assist in arranging the presentation of an interesting, timely, and worth-while Scientific Program for the 1949 Convention.

Your participation by reporting on survey and evaluation studies, on research projects, and on experience with new techniques will be welcomed.

We appreciate the fine cooperation of the State Societies in taking the poll for choice of "special features" for the Convention Program. It shall be our endeavor to arrange those features which are favored by the majority.

We ask your further support by:

1. Encouraging your State Society to sponsor a Paper Writing Contest as recommended by the A.S.M.T. Education Committee and forwarding such papers for possible Convention Program selection. (For details about the Contest refer to Education Committee's notice in this issue.)

2. Notifying the A.S.M.T. Chairman that you are interested in presenting a paper or participating in a panel discussion.

Program Committee:

Mary F. Eichman, Chairman, 440 Lyceum Avenue, Philadelphia 28, Pa.

Ruth Church, 201 S. Broome St., Wilmington, Del.

Evelyn Ballou, 4105 Third St., N.W., Washington 11, D.C.

Joy Austin, 10 Oakhurst Circle, Charlottesville, Va.

Elizabeth Frey, 678 Williams Street, Buffalo, N. Y.

SCIENTIFIC EXHIBITS COMMITTEE

What have YOU done about your Scientific Exhibit for the 1949 Convention at Roanoke? Remember it takes time to prepare the material and also to make the arrangements to exhibit the same. Get started on yours TODAY. Write to the committee for space and other details. There is plenty of material, all it needs is someone to put it in good exhibit form. How many of you have seen the A.S.M.T. exhibits in the past and have resolved to have your state or local society represented at the very next convention? This is your opportunity. Write for details to:

Doris E. Boon, Chairman,

Scientific Exhibits Committee, Box 3149, Charleston, West Virginia.

MISCELLANEOUS ANNOUNCEMENTS

Please submit names AND ADDRESSES of newly elected officers of your state societies when writing to the journal. Reports regarding activities of state societies are printed whenever space permits.

The organizational meeting of the Southeastern Chapter of the Pennsylvania Society of Medical Technologists and Laboratory Technicians was held at the Philadelphia County Medical Society Building on September 27, 1948.

The Oklahoma Society of Medical Technologists is progressing rapidly in the organization of their districts.

Read your committee reports in the journal and see how YOU can participate in the activities of the American Society of Medical Technologists.

The Kansas Society of Medical Technologists meets quarterly. This is a good plan for those states where organization into districts is not feasible.

The Executive Office requests that if you have a copy of the November 1934 issue of the "Bulletin of the American Society of Clinical Laboratory Technicians" that you notify them. This is Volume 1, Number 1, of the AMERICAN JOURNAL OF MEDICAL TECHNOLOGY.

PAY YOUR DUES NOW!

STATE SOCIETIES

ALABAMA: President: Mary Frances James, 812 So. 20th St., Birmingham 5.

Vice-Pres.: Miss Lois E. Van Tassell, 725 Woodward Bldg., Birmingham.

Secretary: Miss Evelyn V. Pow, 1124 So. 20th St., Birmingham.

Treasurer: Miss Erma L. Salter, 708 Tuscaloosa Ave., Birmingham.

Board Members: Mrs. Nellie M. Butler, 2219 Highland Ave., Birmingham; Miss Madie E. Murphy, 2030 Highland Ave., Birmingham; Miss Ruth L. Miller, 119 Bonita Drive, Birmingham.

ARIZONA: Sr. Charles Miriam Strassell, St. Joseph's Hospital, Albuquerque.

ARKANSAS: Pres. Mrs. Rosemary Wright, Davis Hospital, Pine Bluff; Vice-Pres. Mrs. Louise Sadler, 1305 West 25th St., Pine Bluff; Secretary: Sister M. James (Poirot), St. Bernard's Hospital, Jonesboro; Treasurer: Lorene Nussbaum, St. Bernard's Hospital, Jonesboro; Chairman: Lila L. Church, 2116 Orange St., North Little Rock.

CALIFORNIA: Pres. Martha A. Lee, 14239 Victory Blvd., Van Nuys; President-Elect: Barbara Isbell, Vet. Admin. Reg. Office, 325 "B" St., San Diego 1.

Secretary: Hazel Current, 918 17th St., Santa Monica.

Treas.: Amelia Clark, 1232 16th St., Apt. 103, Santa Monica.

Membership Chairman: Jeanne Jorgenson, 900 Modoc St., Berkeley 7.

COLORADO: Pres. Lavina White, Clinical Laboratories of C. W. Maynard, M.D., Pueblo.

Pres.-Elect: Virginia Weir, 1104 Republic Bldg., Denver 2.

Secretary: Mary Fox, 661 Monroe, Denver 6.

Treasurer: Rose Hackman, 4200 E. 9th St., Denver 7.

Membership Chairman: Loretto Hamilton, 516 Republic Bldg., Denver.

CONNECTICUT: President: Florence Pease, Box "W," Newtown.

Pres.-Elect: Anita Charboneau, St. Joseph's Hospital, Stamford.

Secretary: Lydia Brownhill, Meriden Hospital, Meriden.

Treasurer: Eleanor Hapgood, Stamford Hospital, Stamford.

Membership Chairman: Bertha Diem, St. Francis Hospital, Hartford.

DELAWARE: President: Georgene Martha Withers, Delaware Hospital Lab., Wilmington 13.

Pres.-Elect: Mrs. Evelyn G. Scott, 4 Chaplain Ave., Wilmington 131.

Secretary-Treasurer: Mrs. Helen Rairigh, 1693 Concord Pike, Wilmington 284.

Board of Directors: Mr. George A. Neville, Biochemical Research Foundation, Newark; Ruth M. Church, care of Nurses' Home, Wilmington General Hospital, Wilmington.

DISTRICT OF COLUMBIA: President: Mary Ellen Hunter, 1 East Bradley Lane, Chevy Chase, Maryland.

Pres.-Elect: Mary Sproul, 2434 Pennsylvania Ave., N.W., Washington 7.

Secretary: Francis Spear, 4621 South Chelsea Lane, Bethesda, Md.

Treasurer: Charles C. Boone, 1363 Bryant St., N.E., Washington 18.

FLORIDA: President: Eleanor Brenny, 302 Brent Bldg., Pensacola.

Vice President: Sara W. Spears, Riverside Hospital, Jacksonville.

Secretary: Sr. Evangeline Marie, St. Anthony's Hospital, St. Petersburg.

Membership Chairman: Mr. Haydon Kerr, Cedars Hospital, Gulfport.

- GEORGIA: Miss Elizabeth E. Paulson, Sec'y., Savannah S.M.T., 515 East 41st St., Savannah.
- IDAHO: Membership Chairman: Winogene N. McIntyre, c/o Dr. B. C. McIntyre, St. Johns, Washington.
- ILLINOIS: President: Cecelia Korteum, 1164 N. Dearborn, Chicago 10.
 President-Elect: Ellen Skirmont, 5493 South Cornell, Chicago 15.
 Secretary: Helen Gurley, Mt. Sinai Hospital, Chicago.
 Treasurer: Marie McCoy, Holy Cross Hospital, 2700 West 69th St., Chicago 29.
 Membership Chairman: Marie McCoy—see above.
- INDIANA: President: Marie Fae Martin, Lafayette Home Hospital, Lafayette.
 Vice President: Agnes A. Wagoner, 3630 N. Meridian, Indianapolis.
 Secretary: Constance Padden, 3630 N. Meridian, Indianapolis.
 Treasurer: Mr. Willis Overton, 1334 Ringold, Indianapolis 3.
- IOWA: President: Inga Overland, 650-16th St., Des Moines.
 Vice President: Rachel Hall, St. Joseph's Mercy Hospital, Fort Dodge.
 Secretary: Eleanor Amberg, Broadlawns Gen. Hospital, 18th & Hickman Road, Des Moines.
 Treasurer: Mrs. Mae Chader, Slater.
- KANSAS: President: Ada Gregory, Lattimore Laboratories, El Dorado.
 Vice President: Mrs. Marjorie Kaufman, 230 N. Glenn, Wichita 12.
 Secretary: Eileen Ebel, Box 15, Hillsboro.
 Treasurer: Sotera Maduros, 1104 W. 8th St., Junction City.
- KENTUCKY: Dorothea Sheperd, c/o Dr. E. C. McGhee, Ashland, Sec'y., K.S.M.T., or Miss Ida Reilly, Roanoke Hospital Association, Roanoke, Va.
- LOUISIANA: President: Hazel Newton, 2639 Napoleon Ave., New Orleans 15.
 President-Elect: Hermine Tate, Charity Hospital, Lafayette.
 Secretary: Dorothy Edwards, 803 Jordon, Shreveport.
 Treasurer: Clarisse Steeg, 3825 General Taylor, New Orleans 15.
 Membership Chairman: Dorothy Dickinson, Box 1368, Alexandria.
- MAINE: Miss Ida Reilly, Roanoke Hospital Association, Roanoke, Va.
- MARYLAND: President: Miss Betsy H. Schmitz, 118 Midhurst Road, Baltimore.
 Vice-President: Mrs. Florence Singer, 2707 Liberty Heights Ave., Baltimore.
 Corresponding Secretary: Mrs. Norma McElvain, 3068 Tenth St., Baltimore.
 Recording Secretary: Miss Miriam Walsh, 12 York Court, Baltimore.
 Treasurer: Miss Ruth Fugmann, 2908 Evergreen Ave., Baltimore 14.
 Board of Directors: Miss Katherine Dean, 835 Glenwood, Baltimore 12.
 Mr. Edward P. Walker, 206 E. 32nd St., Baltimore 18.
- MASSACHUSETTS: President: Elizabeth French.
 Vice President: Elfrieda Klaucke, 27 Forbes St., Worcester 5.
 Secretary: Katherine Austin.
 Treasurer: Mary Cassidy, Memorial Hospital, Worcester.
- MICHIGAN: President: Mary Catherine Wethington, 448 M.A.C., East Lansing.
 Vice President: Hazel Storeck, 340 E. Grand Blvd., Detroit.
 Recording Secretary: Rachel Mason, 2800 West Grand Blvd., Detroit.
 Corresponding Sec'y.: Laura Peterson, 123 So. Arlington St., Kalamazoo.
 Treasurer: Josephine Buss, Reid City.

MINNESOTA: President: Barbara Tucker, 4623 Browndale Ave., Minneapolis 10.

President-Elect: Grace Mary Ederer, 4621 Bruce Ave., Minneapolis.

Secretary: Mary Conroy, 865 Iglhart Ave., St. Paul 4.

Treasurer: Arlene Magnussen, 806 Second St., S.W., Rochester.

Membership Chairman: Frieda Claussen, 469 Laurel Ave., St. Paul.

MISSISSIPPI: President: Mary Golden Means, 1912 Main St., Columbia.
President-Elect: Mr. Edward G. Michael, Laboratory, The Houston Hospital, Inc., Houston.

Secretary: Sister Helen Marie Ebers, St. Dominic's Hospital, Jackson.

Treasurer: Gladys Elmore, 544 Valley St., Jackson 26.

MISSOURI: President: Miss Anne J. Sommer, 3803 Utah Place, St. Louis 16.

Vice President: Miss Betty Brockland, 4945-A Sutherland Ave., St. Louis.

Secretary: Frances Moore, 825 Charles, St. Joseph.

Treasurer: Genevieve Wood, 5551 Enright, St. Louis.

MONTANA: President: Nancy McGarity, 1145 North 30th, Billings.

Vice President: Sister Marie Pierre (Leonard), St. Vincent's Hospital, Billings.

Sec'y-Treas.: Marie C. Maffei, Allard Clinic, Billings.

Member of the Board of Directors: Sister Pascaline Marie (Oliviero), St. Joseph's Hospital, Lewistown.

Membership Chairman: Sister Marie Pierre, St. Vincent Hospital, Billings.

NEBRASKA: President: Kathern Forest, 2405 S. 10th St., Omaha 8.

Pres.-Elect: Mrs. Mary Gibb, 5019 Huntington Ave., Lincoln.

Vice Pres.: Bernice Elliott, 5107 Webster, Omaha.

Secretary: Doris Dovel, 2123 S. 17th St., Lincoln.

Treasurer: Dorothy Thomas, Rising City.

Membership Chairman: Mrs. Dorothy McMahon, 1933 S. 34th St., Lincoln.

NEVADA: Membership Chairman: Jeanne Jorgenson, 900 Modoc St., Berkeley 7, California.

NEW HAMPSHIRE: President: Veverly Bates, Elliot Hospital, Manchester.

Vice President: Sr. M. Aybert, St. Louis Hospital, Berlin.

Secretary: Annie Clark, Mary Hitchcock Mem. Hospital, Hanover.

Treasurer: Melvin Cooley, Franklin Hospital, Franklin.

NEW JERSEY: President: Phyllis Stanley, 19 West State St., Trenton.

Vice President: Marjorie Edsten, Essex Co. Isolation Hospital, Belleville.

Secretary: Elizabeth Kauderer, Municipal Hospital, Camden.

Treasurer: Margaret Harris, 32 Holmes St., Nutley.

NEW MEXICO: President: Sister Charles Miriam Strassell, St. Joseph's Hospital, Albuquerque.

Vice President: Sister Joan of Arc (Allard), St. Anthony's Hospital, Las Vegas.

Secretary: Jane Wilkins, Veterans Hospital, Albuquerque.

Treasurer: Mr. James T. Reynolds, 203 North Kansas, Roswell.

NEW YORK: President: Mrs. Beatrice Allison, Niagara Sanatorium, Lockport.

Pres.-Elect: Anne Keenan, 31 Cuyler Ave., Albany.

Secretary: Mrs. Kathleen Shaw, Bay Ridge Hospital, 437 Ovington Ave., Brooklyn 9.

Treasurer: Mr. Charles Leiper, 506 Dartmouth Ave., Buffalo.

Executive Secretary: Sr. M. Marcella Barry, 565 Abbott Road, Buffalo 20.

NORTH CAROLINA: President: Sara Hodges, Memorial Hospital, Charlotte.

Pres.-Elect: Anna M. Forney, L 3 A University Apts., Durham.

Secretary: Ruth I. Meissner, 201 Churchill Drive, Fayetteville.

Treasurer: Clara B. New, Veterans' Hospital, Fayetteville.

Membership Chairman: Ruth I. Meissner (see above).

NORTH DAKOTA: President: Sr. M. Eleanor Mischel, St. Alexius Hospital, Bismarck.

Pres.-Elect: M. Claire Murray, State Hospital, Jamestown.

Secretary-Treasurer: Sr. M. Danik (Keily), St. Alexius Hospital, Bismarck.

OHIO: President: Sr. Eugene Marie Carpe, Good Samaritan Hospital, Cincinnati.

Pres.-Elect: Mrs. Berttina Orsborn, Children's Hospital, Columbus.

Secretary: Mr. John Hannon, Holzer Hospital and Clinic, Gallipolis.

Treasurer: Bessie M. Keating, Wright-Patterson Air Force Station Hospital, Dayton.

Executive Secretary: Mrs. Ruth Ulam Clark, Grant Hospital, Columbus.

OKLAHOMA: President: Eleanor Calloway, Stigler.

President-elect: Margaret Haraway, 1115 Medical Arts Bldg., Oklahoma City.

Secretary: Mrs. Gladys Liles, Hillcrest Hospital, Tulsa.

Treasurer: Anne Adwan, 1115 Medical Arts Bldg., Oklahoma City.

OREGON: President: Agnes Marie Lyman, 4015 S.E. 30th Ave., Portland 2.

President-elect: Elsa R. Thompson, 7609 S.W. 33rd Ave., Portland 1.

Secretary: Betsy Baptist, 211 N.W. 21st, Portland 9.

Treasurer: Rose Angela DiLoreto, 3328 S.E. 52nd Ave., Portland 6.

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